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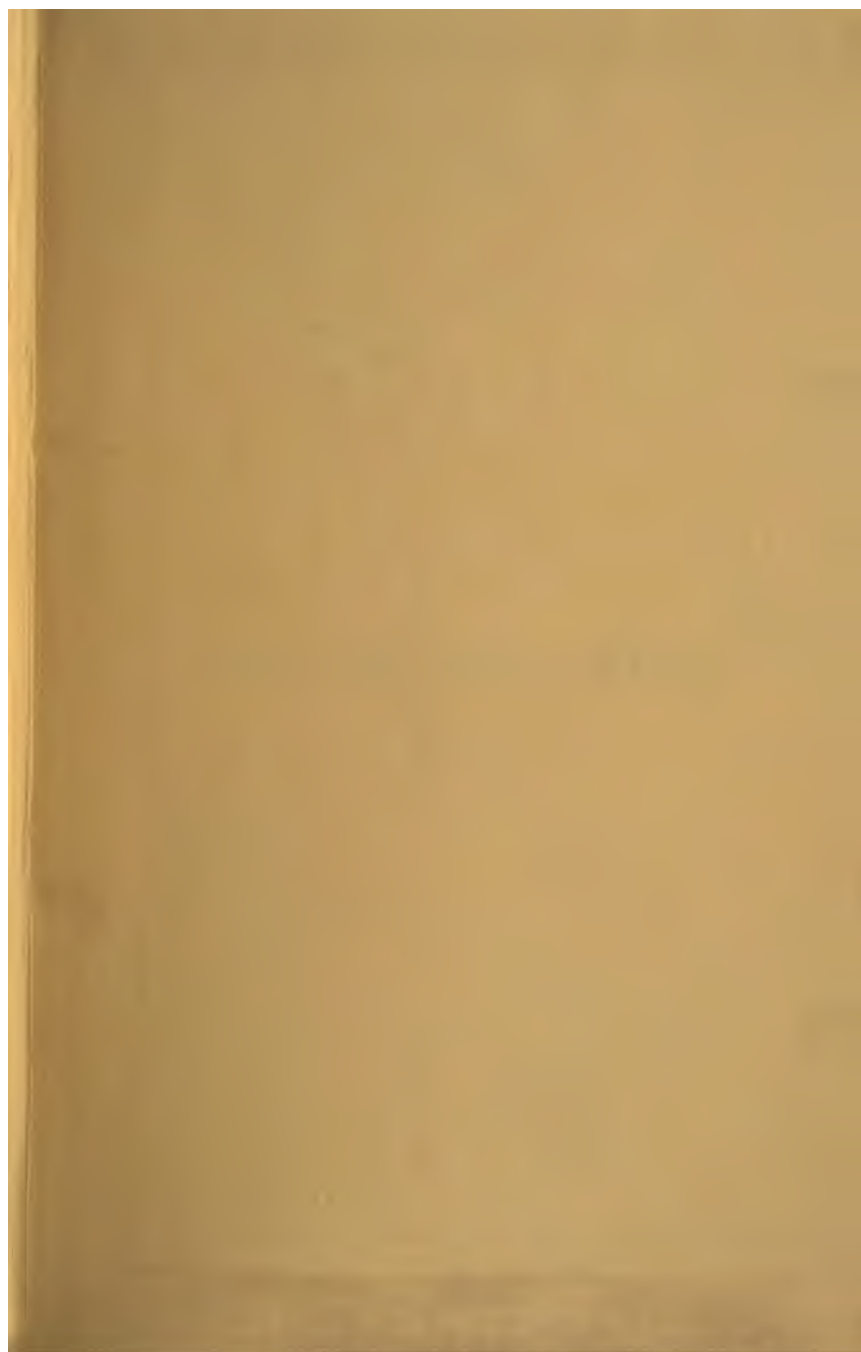




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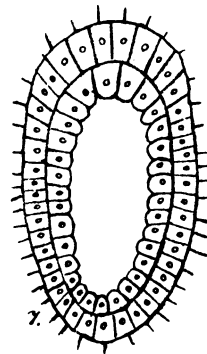
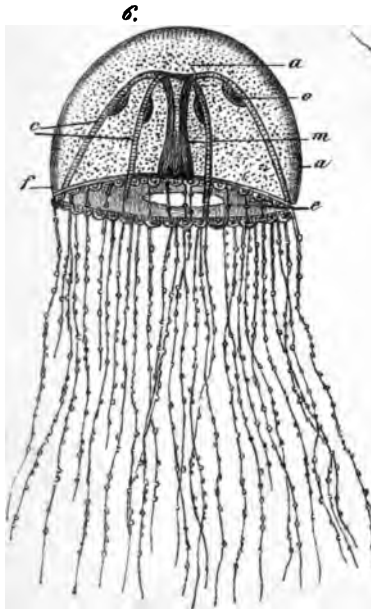
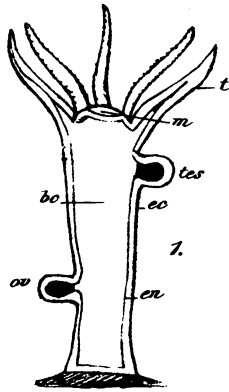


BRITISH ZOOPHYTES.



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PLATE I.

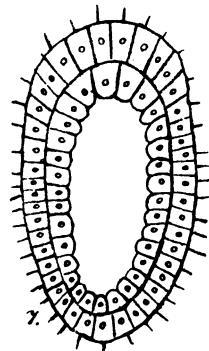
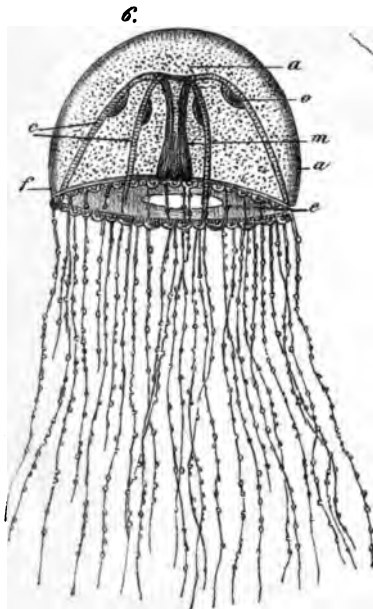
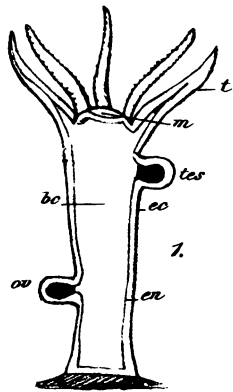


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PLATE I.



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BRITISH ZOOPHYTES:

AN INTRODUCTION TO THE

HYDROIDA, ACTINOZOA, AND POLYZOA

FOUND IN GREAT BRITAIN, IRELAND, AND

THE CHANNEL ISLANDS.

BY

ARTHUR S. PENNINGTON, F.L.S., F.R.M.S.

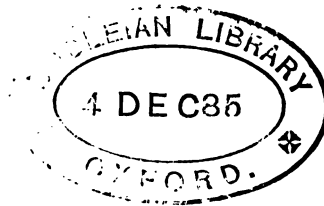
The Zoophyte,
The link that binds Prometheus to his rock,
The living fibre to insensate matter."

Montgomery.

LONDON:

L. REEVE & CO., 5, HENRIETTA ST., COVENT GARDEN.

1885.



TO

CHARLES LOXTON JACKSON,

F.L.S., F.Z.S., F.R.M.S., ETC.,

This Book

IS RESPECTFULLY DEDICATED BY HIS FRIEND,

THE AUTHOR.

PREFACE.

THE object of this book is to furnish a handy and at the same time reliable manual of the British Zoophytes. I am aware that, in using the term "Zoophytes" to cover so extensive a field as that comprised in this book, I lay myself open to some degree of criticism, as many writers confine the term to the Hydroida; but from a popular point of view the Polyzoa are as much plant-like in appearance as the Hydroids; and as the word "Zoophytes" has now no real scientific position, I feel justified in retaining it as a convenient expression, and in applying it in the manner defined in the introductory chapter.

My intention in issuing this work is to do for the present generation of students of natural history what the Rev. Dr. Landsborough did for a former in his "Popular History;" and, as modern science requires more attention to be paid to minute and histological details than formerly, I have endeavoured not only to make the work a complete guide to all known British species, but also, so far as possible consistently with its character, to give an accurate *résumé* of the present knowledge of the microscopic structure of the various organisms described. I am necessarily indebted to the large and valuable works of the Rev. Mr. Hincks, Prof. Allman, Mr. Busk, the Rev. P. H. Gosse, and

Dr. Andres, which, with many others named in Appendix A., I have consulted and compared, and to which it is my hope that this book will act as an introduction.

The various appendices and indexes have been carefully prepared so as to afford all needful assistance, and all synonyms whose identity with present nomenclature has been established have been included in the Index of Species. The Zoophytes have proved a most fertile ground for experimental classification, and the number of synonyms is consequently very large.

The plates with which the book is illustrated have been drawn by my wife, for the most part from specimens in my own cabinet: and I take this opportunity of acknowledging my indebtedness to her for her assistance in my work.

I trust that the objects I have before stated may be fulfilled, and that my efforts may prove of service, not only to students, but also to others in want of a guide to the wonders of the shore.

ARTHUR S. PENNINGTON.

HEATON, near BOLTON,
August, 1885.

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ADDENDA ET CORRIGENDA.

At p. 15, line 13, add "and the European Zoantharia have been fully described and rearranged by Dr. Andres."

At p. 17, line 19, add "and by Dr. Andres."

At p. 135, line 12, for "OLIGAETIS" read "OLIGACTIS."

At p. 176, line 10, omit "and the succeeding."

At p. 222, line 31, for "Sertularia" read "Scrupocellaria."

At p. 227, line 28, and p. 229, lines 24 and 25, for "Monodox" read "Monodon."

At p. 301, line 10, for "Millipora" read "Millepora."

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NATURAL HISTORY

OF

BRITISH ZOOPHYTES.

INTRODUCTION AND HISTORY OF ZOOPHYTOLOGY.

THE study of the various classes of animals which are included in the somewhat paradoxical name of *Zoophytes* is one which will always be attractive to the Naturalist, especially if the microscope form one of his ordinary instruments of observation. Widely separated from each other in structure as these classes are, they, nevertheless, are generally studied together; and, although the name *Zoophyte* has ceased to convey any special meaning, it is still used to denote all those animals, whether belonging to the hydrozoa, actinozoa, or polyzoa, which, judged by their appearance only, would often almost justify the application to them of the term in its literal sense. The animals, which have to be considered under this general term, vary in size as greatly as in structure; and, in giving descriptions of them, we find that they range from the beautifully

conspicuous and attractive anemones to minute forms which are often quite invisible as individuals without the aid of the microscope. The species found in our own country, unlike their relatives, the corals of tropical seas, are not important factors of islands or continents, but, from their extreme variety and beauty and from their curious life-histories, they are objects of interest to the scientific observer, no less than their more useful congeners.

The history of the investigations which have from time to time been made into the various classes of Zoophytes, forms a very interesting narrative, showing the strength of prejudice, even amongst scientific men, who, of all others, should be open to receive truth, however unexpected or unpalatable, and illustrating also the ultimate triumph of patient and careful observation.

The study of Zoophytology, depending, as it does, so largely upon microscopical observations, has naturally been more active and accurate within the last century since the microscope began to be generally used. Prior to that time, it is not at all surprising that naturalists, whose observations must of necessity have been limited, considered Zoophytes as either vegetables or minerals. When the dendritic forms sometimes assumed by crystals are borne in mind, the idea that the more minute of the Zoophytes were mineral crystals does not seem so absurd as might at first appear; and the vegetable theory is not without grounds for justification, when the limited means of observation of its supporters are taken into account.

There seems to be no doubt that until the year 1599 no naturalist had ever been rash enough or bold

enough to claim Animality for any of the Zoophytes, except the Anemones; and it would appear to be somewhat doubtful whether Ferrante Imperato, who in that year is said to have first promulgated the Animal theory, really fully understood the import of his communications. De Blainville, a great authority on the subject, considered Imperato's "*Historia Naturale*" a very important contribution to the study of Zoophytes; but Lamouroux was of opinion that Imperato, in common with other observers, had no distinct notion of the animality of any Zoophytes, and certainly believed in the vegetable nature of almost all of them.

However this may be, the publication of Imperato's views had absolutely no effect in arresting the attention of naturalists; and the vegetable and mineral theories continued side by side for 130 years longer, until they were at length assailed by Peyssonnel, then a physician in Marseilles, and afterwards physician to the king at Guadeloup, in a communication to the Academy of Sciences in Paris. The history of this communication is remarkable.

About sixteen years before Peyssonnel's researches were made known, Count de Marsigli, an accomplished naturalist, had observed the polyps of corals and madrepores, and had published an account of his discoveries, in which he referred to these as flowers and blossoms. Reaumur states that "*this discovery of the flowers of the coral made a great noise in the world of naturalists;*" and it will be easily seen that a misunderstanding as to the nature of the coral polyps, founded on the careful investigations of an observer of repute, increased the difficulties in the way or

Peyssonnel, and caused the Academy at Paris to turn not only a deaf but a disdainful ear to his communication. Peyssonnel appears to have been a very modest man, and withal afraid of the reception which his audacious views would meet. He therefore entrusted his notes to Reaumur, who, thinking his young friend very imprudent, and desiring to shield him from scorn and derision, read the paper to the Society, but kept back the author's name, and himself not only spoke but wrote against the views of Peyssonnel. He did, however, give the latter credit for not writing "entirely from fancy"! Peyssonnel's document, if published at all, is not in existence, and the only record of it is in Reaumur's essay, written against it, and read before the Academy under the title, "Observations upon the formation of Coral and other productions called Stony Plants."

In this manner, therefore, was the light rejected; and the subject was not again broached until 1741. In that year Abraham Trembley conducted a series of experiments upon the *Hydra*, or fresh-water polyp, with respect to its extraordinary recuperative powers, and also discovered *Lophopus Crystallinus*, one of the fresh-water polyzoa, which he called, "*Polype à panache*." His experiments attracted considerable attention both in England and on the Continent. In England his researches upon the *Hydra* were repeated by Baker, who, in 1743, published an elaborate letter*

* The title-page of this publication is curious. It is as follows: "An attempt towards a natural history of the Polype, in a letter to Martin Folkes, Esq., President of the Royal Society, describing their different species, the places where to seek and how to find them, their wonderful production and increase, the form, structure and use of their several parts, and the manner they catch their

to Martin Folkes, the President of the Royal Society, in which he entered into descriptions of his own experiments confirmatory of those of Trembley.

Baker also discovered *Lophopus Crystallinus* in England. He named it the "Bell-flower animal." Leeuwenhoek had discovered the *Hydra* in 1703; but its remarkable properties were not found out until the experiments of Trembley. These experiments were communicated by him to Reaumur, who stated in the preface to the sixth volume of his "*Mémoires pour servir à l'Histoire des Insectes*," that he had repeated the most important of Trembley's experiments, and to his great amazement found every one to exactly answer the accounts given. These curious investigations seem to have attracted the attention of metaphysicians as well as naturalists, for in 1752, Dr. Parsons, F.R.S., found it necessary to publish some "philosophical observations, in which he answered some objections against the indivisibility of the soul, which had been inadvertently drawn from the late curious and useful experiments upon the POLYPUS and other animals;" which observations, that they might

prey. With an account of their DISEASES and CURES; of their amazing REPRODUCTION after being cut in pieces (as first discovered by MR. TREMBLEY at the HAGUE;) of the best methods to perform that operation, and of the time requisite to perfect the several parts after being divided: and also full DIRECTIONS how to feed, clean, manage and preserve them in all seasons of the year, likewise a COURSE of real EXPERIMENTS performed by cutting these creatures in every way that can be easily contrived: showing the daily progress of each part towards becoming a perfect POLYPE. The whole explained everywhere by great numbers of proper figures, and intermixt throughout with a variety of OBSERVATIONS and EXPERIMENTS by Henry Baker, F.R.S." 1743.

have the seal of orthodoxy, he dedicated to the Bishop of London.

The experiments of Trembley, however, had a still further effect upon Reaumur than merely to stimulate his curiosity. They brought to his remembrance the probably forgotten paper of Peyssonnel, and he began to think that there had been less of fancy in Peyssonnel's views than he had been willing to give him credit for. He at once arranged with his friends, Bernard Jussieu and Guettard, that they should go to the seashore, and actually investigate for themselves the facts of the case. They accordingly spent the autumns of 1741 and 1742 in making researches at different localities on the French coast; and so satisfied were they, as the result of their studies, that Peyssonnel's views were correct, that Jussieu presented a memoir in 1742 to the Academy, in which, with particular reference to *Alcyonium digitatum*, *Tubularia indivisa*, *Flustra foliacea*, and *Cellepora pumicosa*, he demonstrated that the marine productions examined by him, which had been ranked as plants, were really the work of a kind of sea insect.

Reaumur himself, in his work already referred to, recounted the researches of his friends who, he said, had recognized that many species of these bodies which had the external appearance of very beautiful plants were only an assemblage of a prodigious number of cells of polyps. He therefore ably supported the views of Jussieu and Guettard, and retracted all his former opposition to Peyssonnel. The new truth did not, however, at once prevail. The opposition it had to encounter from those who held the old views was very fierce; and we are not surprised to find that Peyssonnel himself returned to the attack. In a com-

munication addressed this time to the Royal Society in England, he recapitulated his researches of the previous thirty years ; but his views received no more support in England than they had done in France. Strange to say, we find them opposed in quarters where we should least of all have expected opposition. Baker and Parsons were the two chief opponents of Peyssonnel, both of whom, from their knowledge of the hydra and its structure and history, we should have expected, like Reaumur, to have adopted the new creed. Baker, however, was enamoured of what he called the "vegetative" or dendritic forms assumed by many salts on crystallization ; and he declined to believe that the stony corals and corallines were other than mineral productions ; and as to the horny and pliant forms of zoophytes, these he considered as vegetable in nature.

Dr. Parsons was quite unable to approve of Peyssonnel's views, which he attacked in the Royal Society in the June following the reading of Peyssonnel's paper. In his attack he declared his inability to conceive "that so fine an arrangement of parts, such regular ramifications, and such well-contrived organs to serve for vegetation, should be the operations of little, poor, jelly-like animals." He accordingly stoutly opposed their animality, and insisted that their productions were the work of "more sure vegetation which carries on the growth of the tallest and largest trees with the same natural ease and influence as the minutest plant."

Parsons had not learned the truth which scientific men now recognize, that the weak and little things of the earth are the most powerful factors of its structure and development, a lesson which zoophytology is

well fitted to teach. At last, however, the opposition which would not succumb to the controversies of the learned doctors and masters of science, gave way before the calm investigations of a London merchant. The death-blow to the mineral and vegetable theories alike was struck by the hand of John Ellis, who devoted his leisure time to the study of natural objects. He seems to have lived in undisturbed serenity whilst the conflict of opinion was raging around; as in his book—the publication of which practically settled the question—he does not once allude to the controversy, or appear to be aware of it. The causes which led to the publication of his epoch-making work were as simple and unlikely as could be conceived. Ellis had been in the habit for his own amusement of making pictures of sea-weeds, corallines, &c., in which the sea-weeds served for the groundwork and more prominent objects, and the zoophytes were inserted as trees and shrubs. He informs us, in the preface to his book, that his friend, Dr. Stephen Hales, was pleased to express great pleasure in viewing those landscapes, and desired him to make some for the Princess Dowager of Wales, and also requested him to collect all the varieties our sea-coasts afforded, which he did by the help of his friend, George Sheloocke, Esq., and some of his acquaintances in Ireland. In order to distinguish the proper characters of the different species with greater accuracy, he found it necessary to examine them with the microscope; by which he meant, not the elaborate instrument which modern observers use, but one more like a dissecting microscope, with simple lenses. He early found that the texture of

many forms was such as to indicate an animal rather than a vegetable nature. His views were afterwards considerably extended, and he began to suspect that the Zoophytes generally were animals.

In order to determine these suspicions he went in August, 1752, to Sheppey, in Kent, to examine what he called the branched corallines. From his investigations he was fully convinced that "those apparent plants were really ramified animals in their proper skins or cases not locomotive but fixed to shells of Oysters, Mussels, &c., and to Fucus's."

In June, 1754, he again went to the seaside, this time to Brighthelmstone in Sussex. He presented an account of this journey to the Royal Society. His conclusions were that the Zoophytes generally were animal productions, and that the animals producing them were of similar nature to the *Hydra*, or fresh-water polyp. The final results of his studies were presented in detail to the public, in 1755, in a beautifully illustrated book, called "An Essay towards a Natural History of the Corallines and other Marine Productions of the like kind commonly found on the coasts of Great Britain and Ireland." This work he dedicated to the Princess Dowager of Wales; and in it he gave a full account of all his discoveries, with descriptions of each species, and extremely accurate drawings.

To most of the species he discovered he also gave popular names, which they retain to this day. The entire work is a marvel of scientific accuracy. In his introduction he alludes to a person whom he calls his friend, Dr. Buttner, of Berlin. This doctor, who was a professor at Gottingen, repayed Ellis' friendship by boldly claiming Ellis' discoveries as his own. That

this was an impudent and infamous attempt at fraud is undoubted.

Ellis' researches were fully appreciated in his own country, and, in 1767, the Royal Society presented him with the Copley Prize Medal for his papers on Natural History. In presenting this medal the President of the Society, Sir John Pringle, stated that, although Ellis had opened such a wonderful view of some of the most extraordinary productions of nature, and had pursued his discoveries with such sagacity and judgment that he might reasonably have expected many testimonies of his successful labours in natural history, yet that medal was delivered to him as an express testimony of their approbation of his excellent papers on the animal nature of the genus of Zoophytes called *Corallina*, and of the *Actinia Sociata*.

Ellis contributed no less than twenty-six communications to the Royal Society, exclusive of the work before referred to. He held the office of King's Agent for the Province of West Florida, and Agent for the Island of Dominica. His extensive knowledge of Zoophytes, which was much increased by the facility with which he was enabled to obtain specimens from the countries named, brought him into communication with Linnæus, the prince of naturalists, to whom he wrote several valuable letters, and from whom he received letters equally important. Linnæus seems to have adopted Ellis' views to some extent. The stony corals he had previously assigned to the animal kingdom, and a study of Ellis' views caused him to assign the horny and flexible corallines also to that kingdom, although, in order to mark his opinion on the subject, he founded the order *Zoophyta*, which he defined as

"Plantæ vegetantes floribus animatis." His view seems to have been that the stems and branches of the Corallines, &c., were vegetable in nature, but that the Polyps were animals.

As Linnæus considered that animals were only distinct from vegetables in the possession of a sentient nervous system, with voluntary motion, he had little difficulty in believing that the polyps were animals, while the stems were vegetables, and yet that both were one organism. The reason he gives for this view is curious. He believed that motion of some kind was enjoyed by all living beings. The plants on *terra firma* enjoy the motion of the air; but, as in the depths of the sea there is perfectly undisturbed quiet, the Creator had endowed the terminal portions of the Zoophytes with a nervous system and a power of motion, that they might by their own motions partake of that enjoyment, which the quiescent state of their watery abode could not supply.

The view of Linnæus was adopted by Dr. Job Baster, of Zurichsee in Zealand, who at first was vehemently opposed to Ellis' views, as is not surprising, seeing that he did not know what Zoophytes were, and was arguing from studies of *Confervæ*. When, however, he became better acquainted with the subject, he did not like to recede altogether from the position he had taken up, but adopted the classification and definition of Linnæus as a compromise.

Dr. Pallas also published a history of Zoophytes,*

* This work, called "Elenchus Zoophytorum," was published at the Hague in 1766, and is a most carefully and scientifically written embodiment of the current knowledge of the species and characteristics of the Zoophytes.

in which he adopted the views of Linnæus; but Ellis steadily refused to modify his views, and held out to the last for the complete animality of all Zoophytes. It was the intention of Ellis to write an exhaustive history of the order, but ill-health prevented him, and he got no further than the production of the plates and a number of notes which he compiled with the aid of his friend, Dr. Solander, who after Ellis' death arranged them in form for publication. His intention was frustrated by his own death; but Sir Joseph Banks, the President of the Royal Society, desiring their publication, this was accomplished by Ellis' daughter, Mrs. Watt. In this book the Actiniæ are for the first time included amongst the Zoophytes, which term is therein employed in the sense in which it is now generally received, its use as a term of classification having entirely ceased. Ellis' work was the only one which treated of British Zoophytes alone until the year 1828, although in the meantime many writers had dealt with the subject generally.

In 1780, Otho Fabricius wrote his "*Fauna Greenlandica*." In 1785, Cavolini published an interesting memoir upon marine polyps. In 1816 appeared the second volume of Lamarck's "*Animaux sans Vertèbres*;" and in the same year Lamouroux published his "*Histoire des Polypiers Coralligènes Flexibles*." Lamouroux' work was translated into English in 1824, and was the first English work, subsequent to that of Ellis and Solander, dealing with the subject in its entirety. In 1817, Cuvier's "*Règne Animal*" appeared. In 1828, Dr. John Fleming published a "*History of British Animals*," at the close of which

he gives a list and describes a number of British Zoophytes. About this time also, the first step was taken towards a proper separation of the different constituents of the order Zoophyta, which resulted in the rejection of that name, and in the ultimate adoption of the present system of classification. The Actiniæ were never really included amongst the Zoophyta, and Cuvier had already separated the Alcyonian from the Sertularian polyps; but the distinctions between what are now known as the Polyzoa and the Hydroida were not recognized. These distinctions, however, as soon as perceived, were carefully examined and defined. In 1827, Grant, in a paper read before the Wernerian Society on the structure of Flustræ, pointed out some differences between the polyps of the Flustræ and the Sertulariæ, but he does not seem to have fully observed the intestinal system of the former.

In the following years Messieurs Milne-Edwards and Audouin, in France, pursued the same line of investigation, and, independently of Grant, described the structure of the Flustræ. Mr. J. V. Thompson, in Ireland, was at this time pursuing a careful course of study of the marine productions of the Irish coast, and in 1830 he published a complete description of the polyps of *Bowerbankia*, *Valkeria cuscuta*, and other forms. He named these polyps "*Polyzoa*." In 1834, Ehrenberg published a memoir on the Corals of the Red Sea, in which he divided the polyps into *Anthozoa* and *Bryozoa*, the latter term being synonymous with the term "*Polyzoa*" of Thompson. The term *Bryozoa* had been previously used by Ehrenberg, in 1831, in a number of the "*Symbolæ Physicæ*;" but the application of the term *Polyzoa* to the non-hydroid polyps

was certainly prior to that of the term *Bryozoa*. In England, accordingly, the former term is used, whereas on the Continent *Bryozoa* is the usual appellation.

In the meantime, the writers named, together with Sars, Lister, Lovén, Couch, Van Beneden, and others, had added to the number of the species and to the general knowledge of the subject; and, in 1838, Dr. Geo. Johnston published a valuable treatise on the British Zoophytes, which has been the most important work on the subject until the recent publications of the Rev. Thomas Hincks and Prof. Allman.

Of Dr. Johnston's work, which was illustrated by a number of beautiful plates drawn from nature by his accomplished wife, a second and much enlarged edition, in two volumes, was again issued in 1847.

In 1852, the Rev. Dr. Landsborough published a very interesting and carefully written popular history of British Zoophytes, which, however, did not aim to supplant the treatise of Dr. Johnston. In 1856, Prof. Allman issued through the Ray Society a monograph of the fresh-water Polyzoa, which still continues the standard authority upon that branch of the subject. In 1864, the Rev. P. H. Gosse, whose attractive writings have thrown a halo of poetry around the subject, published a history of the Sea Anemones or Zoantharia, which is a most valuable and complete work dealing with the whole of the British species. This book is illustrated by magnificently coloured plates of the species described. The anatomical and physiological structure of the Sea Anemones has been exhaustively studied by the Brothers Hertwig, who, in 1869, published a treatise thereon in Jena, and Prof. Richard Hertwig has since written the section of the

"*Challenger Reports*" devoted to the Actiniaria. In the latter publication is contained a summary of his own and his brother's researches.

Mr. Busk has also published a Catalogue of the British Museum Collections of Polyzoa, which is illustrated by accurate and beautiful plates of many of the species described. This catalogue is not confined to British species. In addition to the writers named, many others whose names and works are referred to in the Appendix, have contributed to our knowledge of the species of Zoophytes, and of their structure and life-history.

The chief present authorities on the British Polyzoa and Hydroida are the valuable and exhaustive monographs on those branches (published, the former in 1868, and the latter in 1880) by the Rev. Thomas Hincks, F.R.S., of Budleigh Salterton, Devon, and the monograph on the Tubularian Hydroids by Prof. Allman, published by the Ray Society.* These books, from the accuracy of the descriptions and the beauty and completeness of the illustrative plates, will long continue the text-books on the subjects with which they deal. This review of the history of our knowledge of the Zoophytes is necessarily short; but, brief and incomplete as it is, enough has been said to show that this beautiful and important group of animals has long attracted the attention of the scientific world, and has been repeatedly and carefully studied. The labours of naturalists spent in unravelling the mysteries of Nature may often appear trifling and

* Prof. Allman is engaged in investigating the Hydroida of the "*Challenger*" Expedition, and his first communication on the *Plumularidæ* has just appeared. 1883.

unimportant, but by one who considers Nature's workings as the manifestations of Divine energy, no such terms can be applied to these studies; and, even to those who think that they can dispense with a Creator, and who see in matter itself something which has existed from all eternity and is sufficiently potent to produce life and all its accompanying phenomena, the study of that matter in its living forms, even in those of the lower organisms, cannot be otherwise than productive of good; and to those who look for beauty merely, and who would find in Nature that perfection and symmetry which they fail to find in art, the study of these animals with their varied and often highly coloured forms, and with their richly chased cells and structures, must be gratifying and attractive.

In "Glaucus," the late Canon Kingsley says, "The research which has been bestowed upon these unnoticed atomies has well repaid itself; for from no branch of physical science has more been learned of the *scientia scientiarum*, the priceless art of learning. No branch of science has helped so much to sweep away that sensuous idolatry of mere size, which tempts man to admire and respect objects in proportion to the number of feet and inches which they occupy in space."

To the microscopist the Zoophytes present a field for study and observation of unlimited extent. So many questions of importance remain to be answered, so many life-histories to be worked out, that no one who enters upon this study can complain of dearth of material to work upon. On every sea-shore their beautiful skeletons may be picked up, and the living forms may be readily obtained by dredging; and when

we consider that each one "is a miracle passing thought with insoluble wonders of birth," we are fain to re-echo the sentiment with which the old observer Fabricius closed his book—"Remota etiam Deum enunciant," and to confess that, as has often been expressed,—

"Figured by hand divine there's not a gem

Wrought by man's art to be compared with them."

GENERAL CLASSIFICATION AND DISTRIBUTION.

It would be useless, in a work of this kind, to present all the various systems of classification which, from time to time, have been proposed for the species hereafter described. It will be sufficient to set out, with such explanatory notes as may be necessary, the classifications which appear to the author most successfully to satisfy the requirements of the subject, and to define sufficiently the leading characteristics of the various species. The works of Mr. Hincks, Mr. Gosse, Prof. Hertwig, and Prof. Allman, alluded to in the introduction, contain systems of classification as complete as the present state of knowledge will permit.

The general system of classification adopted is as follows:—

To the sub-kingdom *Cœlenterata* (hollow-bodied animals) belong all those animals with more or less radiate structure, in which the alimentary canal freely communicates with the general or "somatic" cavity. They are also furnished with tentacles armed with stinging cells or *cnidæ*. This sub-kingdom is divided into two classes: I. The *HYDROZOA*, in which the wall of the digestive sac is not separated from that of the somatic

cavity, and the reproductive organs are external; and II., the ACTINOZOA or ANTHOZOA, in which the wall of the digestive sac is separated from that of the somatic cavity by an intervening space subdivided into chambers by a series of vertical partitions, on the faces of which the reproductive organs are developed. (*Greene*, "Cœlenterata.")

The HYDROZOA are divided into three orders, viz.: I., the HYDROIDA; II., the SIPHONOPHORA; and III., the DISCOPHORA or LUCERNARIDÆ. The first of these orders only will be dealt with in this book, and will be described more fully in the part specially devoted to it.*

The ACTINOZOA or ANTHOZOA are divided into two orders, namely, the ZOANTHARIA and the ALCYONARIA, the distinguishing characteristics of which will be afterwards described.

The preceding groups are separated from the remainder of the animals usually included in the expression "Zoophytes" by three sub-kingdoms, the ECHINODERMATA, the ARTICULATA, and the VERMES, the two latter of which are sometimes comprised in one sub-kingdom, called the ANNULOSA.

The POLYZOA, as the remaining group of the Zoophytes is called, constitute a class of the sub-kingdom MOLLUSCA, which consist of soft-bodied, unsegmented animals, usually provided with an external skeleton, and having a nervous system in the form of one to three principal pairs of ganglia. The POLYZOA are

* Those who wish to study the Siphonophora and Discophora are referred to *Greene's* "Manual of the Cœlenterata," 1875; to *Huxley's* "Monograph of the Oceanic Hydrozoa," Ray Society, 1859; *Forbes's* "Monograph of the British Naked-eyed Medusæ," Ray Society, 1848; and *Haeckel's* "System der Medusen," 1879.

considered to belong to this sub-kingdom from the fact of their possessing a distinct alimentary system, and more especially from the facts that their tentacles perform the functions of gills and are respiratory organs, and that they possess a nervous ganglion. The POLYZOA may be defined* as "Acephalous Mollusca, with free oral tentacles serving as gills, and having the mouth and anus near together, separated or not by the tentacles. They are enclosed in a cell, and usually form colonies by continuous gemmation." Some naturalists assign the POLYZOA to a division of the MOLLUSCA designated the MOLLUSCOIDA, which includes the POLYZOA, TUNICATA or sea-squirts, and BRACHIOPODA.

The POLYZOA are divided into two sub-classes according to the shape of the *lophophore*, the name given to the stage which supports the tentacles. The first sub-class is the HOLOBRANCHIA, in which the *lophophore* is either circular or horseshoe-shaped, and the wreath of tentacles is unbroken. In the second sub-class, or PTEROBRANCHIA, the *lophophore* is continued on each side into a process upon which alone the tentacles are borne, which therefore are discontinuous.

The HOLOBRANCHIA contain two groups, namely, the ECTOPROCTA, in which the anal orifice is outside the *lophophore*, and the ENTOPROCTA, in which both the anal and oral orifices are within the *lophophore*. The ECTOPROCTA contain two orders, the PHYLACTOLÆMATA and the GYMNOLEMATA. The former of these orders includes most of the fresh-water POLYZOA, and embraces those forms in which the *lophophore* is bilateral, and the mouth is furnished with an *epistome* or valve-like organ arching over it.

* Hincks, British Marine Polyzoa, cxxxv.

The order GYMNOLEMATA includes those forms in which the *lophophore* is orbicular or nearly so, and the *epistome* is wanting. This order includes all the marine forms and the fresh-water genus *Paludicella*. The group ENTOPROCTA contains the single order PEDICELLINEA. The sub-class PTEROBRANCHIA contains the order PODOSTOMATA, with its single family RHABDOPLEURIDÆ.

It will be well here to explain what is meant by the Bathymetric distribution of Zoophytes. Forbes has laid down certain zones of depth into which the sea may be divided, so as to indicate the area of occurrence of organic life. It must, however, be premised that the statements as to occurrence in certain zones are only approximately true, as many species are found in more than one zone. The four zones into which the waters surrounding our coasts are divided are—the Littoral zone, which extends between the levels of the ebb and flood of ordinary tides; the Laminarian zone, extending below the littoral zone to the area only uncovered at spring tides; the Coralline zone, extending from the laminarian zone to a depth of 50 fathoms; and the Deep-water zone, which underlies this to a depth of 100 fathoms. To these zones Prof. Allman adds the Surface zone, which comprises the area extending to a depth of two or three feet below the surface of the sea, where the medusæ of the various Hydroids abound in countless myriads.

The principal species of Zoophytes are distributed bathymetrically as follows :*—

LITTORAL ZONE. *Clava squamata*, *C. multicornis*,

* Alder, Cat. of North. and Dur. Zoophytes. Allman, Gym. Hyd., 167.

Coryne pusilla, *Syncoryne eximia*, *Clavatella proli-
fera*, *Tubularia larynx*, *Sertularia pumila*, *Plumularia
echinulata*, *Campanularia flexuosa*, *C. integra*, *Clytia
Johnstoni*, *Gonothyræa Loveni*, *Actinia mesembryanthe-
mum*, *Sagartia troglodytes*, *Tealia crassicornis*, *Eucratea
chelata*, *Cellepora Costazii*, *Umbonula verrucosa*, *Schizo-
porella unicornis*, *S. spinifera*, *Cribrilina punctata*,
Microporella impressa, *Membranipora pilosa*, *Flustrella
hispida*, *Scrupocellaria reptans*, *S. scruposa*, *Bower-
bankia imbricata*, *Valkeria uva*, *Pedicellina cernua*.

LAMINARIAN ZONE. *Tubularia indivisa*, *T. bellis*,
Coryne vaginata, *Myriothele Cocksii*, *Sertularia oper-
culata*, *Sertularella rugosa*, *Plumularia setacea*, *Aglao-
phenia pluma*, *Obelia geniculata*, *Calycella syringa*, *C.
Johnstoni*, *Schizoporella hyalina*, *Mucronella coccinea*,
Membranipora membranacea, *M. pilosa*, *M. Flemingii*,
Bugula plumosa, *B. turbinata*, *B. avicularia*, *B.
flabellata*, *Flustra foliacea*, *F. securifrons*, *Alcyonidium
gelatinosum*, *A. hirsutum*, *Crisia eburnia*, *C. denticu-
lata*.

CORALLINE ZONE. *Corymorpha nutans*, *Hydractinia
echinata*, *Eudendrium ramosum*, *E. rameum*, *Perigoni-
mus serpens*, *Tubularia gracilis*, *Halecium halecinum*,
H. muricatum, *Sertularella polyzonias*, *Diphasia tama-
risca*, *D. fallax*, *Sertularia abietina*, *S. argentea*, *S.
filicula*, *Thuiaria thuja*, *Hydrallmania falcata*, *Plumu-
laria pinnata*, *P. Catharina*, *P. frutescens*, *Obelia
longissima*, *Campanularia volubilis*, *C. verticillata*,
Lafoëa dumosa, *Coppinia arcta*, *Antennularia antennina*,
Tealia crassicornis, *Actinolobadanthus*, *Bolocera Tuediæ*,
Pennatula phosphorea, *Diastopora patina*, *Idmonea ser-
pens*, *Cellepora pumicosa*, *Gemellaria loricata*, *Smittia
trispinosa*, *Membranipora unicornis*, *Bugula flabellata*,

Flustra papyracea, *Cellaria fistulosa*, *Alcyonidium parasiticum*, *A. mamillatum*.

DEEP-WATER ZONE. *Tubularia simplex*, *T. attenuata*, *T. indivisa*, *Lafoëa fruticosa*, *Halecium muricatum*, *H. labrosum*, *Sertularella Gayi*, *S. tricuspidatum*, *Sertularia abietina*, *S. fusca*, *Campanularia gracillima*, *Diphasia pinaster*, *Thuiaria thuja*, *T. articulata*, *Lyto- carpus myriophyllum*, *Plumularia Catharina*, *Tealia digitata*, *Diastopora obelia*, *Stomatopora major*, *Cellepora pumicosa*, *C. ramulosa*, *Palmicellaria Skenei*, *P. cribraria*, *Smittia trispinosa*, *S. reticulata*, *Schizoporella linearis*, *Menipea ternata*, *Mucronella Peachii*, *Bugula Murrayana*, *Retepora Beaniana*.

HYDROZOA.

I. HYDROIDA.

Description of the Structure of the Hydroida.

In order that a clear idea may be conveyed of the structure of the Hydroida, it will be well to describe fully that of the most easily accessible member of the order, the common fresh-water polyp or *hydra*; and from that description to trace the formation of the fixed forms, which may be looked upon as compound hydræ. In Plate I. fig. 1, will be found a diagram of the structure of the *hydra*, from which it will be seen that the animal consists of a gelatinous body or sac, one end of which, called the *proximal* end, is expanded into a disc or foot, whilst the other end or oral extremity, called the *distal* end, is occupied by the mouth (*m*) and tentacles (*t*). The form of the body of the

hydra is exceedingly mutable, the animal having the power of changing its shape in the most protean manner. At one time it appears fully extended, long and thin; at another time it is rolled up like a ball. The substance of which the body wall is composed is sarcode. This body wall consists of two layers, the *ectoderm* (*ec*) and the *endoderm* (*en*). The ectoderm contains two kinds of cells, large conical ones with the broad end outwards, and smaller round cells between the tapering ends of the larger ones.

Among the cells of the ectoderm are what are variously called urticating capsules, nematocysts, cnidæ, or thread cells. These cells are a peculiarity of the Cœlenterata. They are oval bags, each containing a thread or filament capable of being suddenly extended on the slightest pressure. Some of the cells contain a sheath provided with three recurved barbs, round which the thread is coiled: the barbs probably act as a spring. These cells appear to secrete a poisonous fluid, which, from the fact that it deposits metallic silver from the nitrate of that metal, is believed to be formic acid. The threads on extrusion pierce the body of the object which the hydra wishes to secure as its prey, and convey into it the poison, to the effect of which it speedily succumbs. The threads assume varied forms in the different species of Cœlenterata; and even in the same species there is often great diversity. In Plate I. figs. 3, 4, 5, are shown diagrams of the thread cells with the threads at rest and exerted. Between the ectoderm and the endoderm is a layer of fibres which are prolongations of the larger cells of the ectoderm, and appear to serve the purpose of muscles. Between the muscular layer and the endo-

derm is a distinct, delicate, structureless membrane called the "supporting lamella," described by Mr. J. T. Parker in the Proc. Roy. Soc., 1880. The muscular layer, with its supporting membrane, is called "the mesoderm." It has been found that the thread cells are connected with the mesoderm by fibrils. These are considered by some observers as muscular, and by their contraction and extension supplying the necessary force for the ejection of the filaments.* Others, however, consider that they are only supporting fibres.

The cells of the endoderm are arranged in a single layer, and are large and nucleated; the base is somewhat flattened, but the free end is rounded and furnished with *cilia*, which are in constant motion, and serve to keep in circulation the fluids in the interior of the sac. Dr. A. Weismann† has pointed out that the circulation of the fluids is also aided by rhythmical contractions or pulsations of the body wall. This applies to hydroids generally. The endoderm cells in the hydra are also noticeable from the fact that in one species, *H. viridis*, they contain a green colouring matter which has been clearly ascertained to be chlorophyll. This fact has been rendered certain by spectrum analysis and other methods.‡ As chlorophyll has until recently been considered an exclusively vegetable product, many observers hold that the green colouring matter is caused by minute algæ which have penetrated into the substance of the hydra. This view, however, does not accord with the results obtained by the majority of

* See J. R. M. S., 1882, p. 200.

† Zool. Anzeig. iv. (1881), 61—64.

‡ Semper, "Animal Life," p. 83.

those who have investigated the subject, and we may conclude that chlorophyll is present in the protoplasm of *Hydra viridis* as an animal and not a vegetable product. The cells of both the ectoderm and endoderm are vacuolated. This causes the granular appearance seen under the microscope. The base of the hydra is extended into a disc, the cells of which are to be distinguished from the other ectodermal cells by their cylindrical form, the possession of a highly refractive fibrilla, and the presence of a similarly refractive mucous secretion by means of which the animal is capable of attaching itself temporarily to any object. Herr Korotneff* proposes to call these elements "glandular muscular." Some observers have described a narrow canal or passage leading through the disc from the body cavity for the passage of excrementitious matter,† but the existence of this passage is denied by others and is very doubtful. At the opposite end of the body is the mouth or oral orifice (Plate I. fig. 1 m). In many of the hydroids this mouth is placed at the end of a pyramidal projection. Prof. Allman calls this projection or proboscis the *hypostome*: but, as this proboscis does not possess any special function, it can hardly be considered a separate organ. It appears to be a mere modification of the shape of the distal end of the hydroid. The mouth opens directly into the body cavity (*bc*) or interior of the animal, which is hollow throughout. Around the mouth of the *hydra* are a row of tentacles, or prehensile organs, of great extensibility, which are furnished to their very extremity with thread cells. In the *hydræ* proper, these tentacles are

* Zool. Anzeig. iii. (1880), 454.

† Greene, "Manual of Cœlenterata," p. 22.

hollow, but in some other species the body cavity is obliterated, and they only show the ectodermal and endodermal layers before described. In many of the hydroids the tentacles are not arranged in a regular row round the mouth, but arise in one or more circles which sometimes spring from various parts of the body.

The object of the tentacles is to seize the prey upon which the hydra feeds, and to convey it to the mouth, but no farther.* The mouth is slowly stretched over the food until it is all received into the body cavity, where it is passed round and round until what is nutrient has been absorbed, after which the remainder is ejected through the oral orifice. It is strongly insisted by many observers that the endoderm cells have active amœboid movements, sending out pseudopodia during digestion to such an extent as to nearly or quite obliterate the digestive cavity. Mr. Parker, in the communication before referred to, considers that solid food particles actually pass into the cells, so that the hydra presents the characteristically protozoan mode of digestion. In one case he observed a diatom frustule embedded in the protoplasm of a cell. This intracellular digestion is regarded by Prof. Metschnikoff † as the rule in most of the true Cœlenterata, having been observed in all the chief groups of that subkingdom.

The hydræ, unlike the rest of the hydroids, are capable of locomotion either by free swimming through the water, or by crawling with a looped motion like that of a caterpillar.

* Mr. Hertwig, Quar. Journ. of Mic. Soc. xx. (1880), 243.

† Zool. Anzeig. iii. (1880), 261.

The ordinary method of reproduction in the hydræ is by gemmation, or budding, a small bud appearing upon some part of the body and ultimately developing tentacles, and becoming exactly like its parent, upon which it drops off and commences a separate existence. Occasionally, however, another bud grows from the former one before it drops off, and in this case three generations appear attached together. In the warm period towards the end of summer, reproduction takes place by means of ova. The ovary (*ov*) is situated on the exterior of the body, and contains the ova, which are fertilized from the sperm cells (*tes*), which are produced in the neighbourhood of the tentacles. Both elements are developed in the ectoderm. Unlike other hydroids, the embryological process is abbreviated in the hydræ, and they do not go through the planula stage, which will be described later.

The hydra, in common with many other hydrozoa, possesses remarkable recuperative powers. In fact, injury seems to be rather beneficial than otherwise: cutting a hydra in two has no worse effect than that of causing two hydræ to be produced.

The experiments of Trembley, Baker, and others on this question were very minute. They appear to have mutilated the hydra in all possible ways, without exhausting its recuperative power; and these experiments have been recently repeated by Mr. Dunkerley, of Manchester, who has described (in the "Microscopical News," vol. iii. p. 272, October, 1883) several successful dissections which resulted in the production of perfect hydræ from the mutilated parts.

The polypites or hydranths of the compound hydroids

resemble in structure the simple hydra. If we imagine the young hydræ produced by budding from the body of a hydra to continue attached to the parent instead of dropping off, and the process to continue indefinitely, we obtain a good idea of the formation of a hydroid colony. It will be understood that in such a case the food taken in by any one hydra would serve for the general nourishment, and that really the colony would be one animal with many mouths, its different parts being connected by extensions of the body wall. This structure will be more readily perceived by reference to Plate I. fig. 2. Most of the hydroids secrete chitinous coverings called *polyparies* or *perisarcs*, which protect the soft connecting tissue, and form receptacles in which the separate polypites are lodged. The connecting tissue is called the *cœnosarc*. It is hollow, and leads into the digestive or body cavity of each polypite. This *cœnosarc* contains the two layers of cell structure already described as forming the body wall of the hydra, and is, in fact, an extension of such walls between the several polypites. The *cœnosarc* is attached to the polypary by processes which are in nearly constant movement. This movement is slow and amœboid, new processes of attachment being developed, and fine films of the ectoderm gradually growing larger and thicker, thus showing a close analogy with the pseudopodial processes, by means of which some rhizopods are attached to their shell.*

In Plate I. fig. 2, the separate polypites with their respective ectoderm (*ec*) and endoderm (*en*) are seen to be lodged in openings in the polypary (*d*), which encloses the *cœnosarc* (*c*). The hollow (*a*) of the *cœnosarc*

* Dr. A. Weismann, Zool. Anzeig. iv. (1880), 61—64.

is seen to form a source of communication between all the members of the colony. The receptacle, or part of the polypary in which the polypites of the sub-order THECAPHORA are lodged, is called the *hydrotheca* or *calycle*. The whole company of polypites forming a hydroid colony is called the *trophosome*.

A constant circulation of nutrient particles is kept up throughout the *cœnosarc*, by which means every portion of the colony is nourished, and, to aid in the circulation of these particles, the endoderm of the *cœnosarc* is richly ciliated.

The calycles of the various species of Thecaphora are often very beautiful structures, and serve very largely for identification. In some species they are open, but in others they are furnished with an *operculum* or hinged valve, which serves as a further protection for the polypites. This valve varies in shape, in some species it is simple and in one piece, while in others it is complex, the various parts converging to a point.

The enlargement of a colony proceeds by gemmation from the *cœnosarc*. The plan of gemmation is very uniform, each species having its own characteristic mode of branching, and the buds being produced at such places on the *cœnosarc* as best serve to preserve the typical form of the species.

In addition to the ordinary polypites of the colony which may be called alimentary zooids, there are produced at certain seasons of the year sexual zooids for the purpose of forming new colonies, and the phases of reproduction in the hydroida present some of the most curious life-histories known to science.

The sexual zooids or *gonozooids* are produced in *gonophores* or reproductive buds which spring from

different parts of the colony. In the *Thecaphora* they are always produced from the cœnosarc, and protected by a chitinous *gonotheca* or capsule. In the *Athecata* they are not protected, and arise from various portions, in some species of the cœnosarc, in others of the polypite. The gonophores consist of an outer covering or *perigonium* and the contained gonozooid. The gonozooids are either fixed or free. Those that are fixed discharge their contents, whether ova or sperm cells, on the spot.

The free gonozooids, on the other hand, at a certain stage break out of the gonophore, and enter upon a separate existence as medusiform zooids (see Plate I. fig. 6). The form of this free gonozooid is that of an umbrella or swimming-bell (*a*), which by its constant systole and diastole floats about in the water. From the centre of the bell hangs a *manubrium* (*m*), which is hollow and terminates in a mouth. At the end opposite to the mouth it joins four tubes (*c*) which extend to the margin of the umbrella, and there pour their contents into a small channel (*f*) which runs round the bell. The bell is partly closed at the bottom by a *velum* or veil, which is perforated in the centre (*e*) to admit of the passage of food to the mouth. The margin of the bell is furnished with tentacles, at the base of which are developed often eye-like spots (*ocelli*) which are believed to serve the purposes of vision. They are, however, very rudimentary organs. The medusiform zooid is capable of reproducing its own form by gemmation, just as the ordinary hydra, but ultimately the elements of reproduction are developed in the neighbourhood of the manubrium. When these elements are ready for dispersion, the

zooid enters upon a state of quiescence, and dissolves away in the process of fulfilling its mission.

The medusiform zooids were for a long time considered as distinct animals, but the life-history of a number of species has been worked out by many careful observers.

After the liberation of the ova and its fertilization, whether the liberation has been from a fixed or a free gonozooid, the usual process of segmentation commences which results in the development of a free ciliated larva, called by Dalyell a *planula*. This planula (Plate I. fig. 7) may be defined as a closed ciliated hollow sac with double walls. After several days, during which it swims about freely, it drops its cilia and becomes extended at one end into a kind of base or disc, by which it attaches itself to some object. It now becomes covered with a chitinous layer within which, at the upper extremity, the tentacles are developed. After a time this layer is ruptured and the tentacles liberated, a mouth also being now formed, and the typical form of the species is ultimately assumed. As before stated, in *Hydra* the planula stage is suppressed. This was also thought to be the case in *Tubularia*, but recent researches seem to show that this genus presents no diversity from the regular mode of development.

The presence of a nervous system or sense organs in the Hydroida has been often sought for, and recently not without success. Prof. Allman, in the *Annals and Mag. of Nat. Hist.* for November, 1874, and afterwards in the *Proc. of the Royal Society* for February 11, 1875, describes the structure of *M. Phrygia* (*M. Cocksi*), and states that between the ectoderm cells proper and

the muscular layer is a deeper zone of the ectoderm which may have nervous functions. This he calls the *claviform tissue*. The tentacles terminate in capitula in which this claviform tissue is represented by a rod-like tissue, "forming a thick hemispherical cap over the muscular lamella and endoderm of the tentacle, and composed of exceedingly slender prisms closely applied, with their inner ends resting on the muscular lamella, to which the prisms are perpendicular. Extending in a radiating direction from the convex surface of the rod tissue towards the exterior of the tentacle, may be seen numerous fine filaments, each of which, making its way among the cells of the ectoderm, terminates in a very delicate transparent oviform sac, which carries a minute styliform process. Within this sac is an oviform capsule, with firm transparent walls, having immersed in its clear refringent interior a cylindrical cord wound upon itself in two or three coils, which cord may be forced out through the smaller end of the capsule." Prof. Allman "is compelled to regard the whole system as an apparatus of sense, in which sight and touch show themselves in one of their earliest phylogenetic stages, in which they have not yet become fully differentiated from one another." C. F. Jeikeli* also considers that he has discovered sense organs in the tentacles of *Eudendrium*, confined to the ectoderm, which sense organs appeared to be continued, as a nervous system, into the *cœnosarc*. The *palpocils* found on the false tentacles of the *Pennariidæ*, and on the tentacles of *Clava*, &c., appear also to have a sensory action.

In addition to the alimentary polypites and repro-

* Zool. Anzeig. v. (1881), 43, 44.

ductive zooids, there are in the family *Plumulariidae*, what have been called guard polyps or machopolyps. These are extensions of the *cœnosarc* lodged in nematophores or *sarcothecæ*, which are tubular extensions of the polypary, or chambers of the walls of the calyces, and serve to guard the individual polypites in some way from injury, or to assist in the capture of food. They have been recently discussed by Dr. R. Von Lendenfeld in the *Ann. and Mag. of Nat. Hist.* for October, 1883; but were first described by Mr. Busk (*Hunterian Lectures*, 1857), and afterwards by Prof. Allman in the *A. and M. of N. H.*, 1864, p. 203, and in his "*Gymnoblastic Hydroids*," and by Mr. Hincks, in his "*British Hydroid Zoophytes*."

Dr. Metschnikoff (*Q. J. M. S.*, xxiv. 91, 92) considers that "the chief function of these orders is prophylactic, and that they eat up the necrotic parts of the colony; and continually explore the organs in their vicinity in order to render harmless, by devouring them, any injurious bodies that may be present." He shows that the contents of the *sarcothecæ* are capable of extending themselves into the neighbouring calyces, and by a process of intra-cellular digestion absorbing any dead hydranths that may be there.

It only now remains to notice the quality of phosphorescence possessed by many of the *Hydroida*, both in their complete and in their medusoid states. The immense numbers of fixed and free zooids which are contained in the neighbourhood of our shores, are amply sufficient to account for the phosphorescent appearance of the sea:—

"Soft, brilliant, tender, through the wave they flow,
And make the moonbeams brighten where they glow."

Mr. Gosse describes the beauty of this phospho-

rescence very graphically in his "Devonshire Coast." He states that going into his study after dark, he took a stick, and felt at random about the water in which his captive hydroids were confined. Presently he touched something soft, and instantly a circle of bright little lamps was lighted up like a coronet of sparkling diamonds, or like the circular figure of gas jets lighted at a public illumination. He states in another place, that the luminosity of a species of *Medusa* observed by him, reminded him of the ring of glory in the pictures of the Italian School round the heads of saints. It would appear that the sub-order *Athecata* does not include any phosphorescent species.* There can be no doubt that much of the apparent phosphorescence is due to the presence of infusoria and other organisms which shelter among the calyces and upon the stems of the hydroida, as on several occasions I have found displays of this quality, which have apparently proceeded from the Zoophytes, to be due to other organisms.

CLASSIFICATION OF HYDROIDA.

The order Hydroida contains all the forms which have been assigned by Huxley, Greene, and others to the sub-orders Hydridæ, Corynidæ, and Sertularidæ. The order, as so extended, contains all those Hydrozoa whose hydrosoma or trophosome is either free and consists of a single locomotive polyp, or is fixed and consists of one polyp or of several connected by a cœnosarc, with or without hydrothecæ, and often developing a polypary or firm outer layer. The reproductive organs appear either as, in the *Hydra*, simple processes from the body walls, or as gonophores.

* Allman, "Gymnoblastic Hydroids," 146.

The Hydroida have been divided by Mr. Hincks into three sub-orders: 1. The ATHECATA; 2, the THECAPHORA, and 3, the GYMNOCHROA. These sub-orders exactly correspond with those established by Prof. Allman, and which he names *Gymnoblastea*, *Calypptoblastea*, and *Eleutheroblastea*.

The sub-order ATHECATA, or *Gymnoblastea*, contains those genera in which the polyps and gonophores are not lodged in external protective receptacles, that is, are not protected by hydrothecæ or gonothecæ. This sub-order contains the families *Clavidae*, *Hydractiniidae*, *Podocorynidae*, *Hydrolaridae*, *Corynidae*, *Pennariidae*, *Clavatellidae*, *Myriothellidae*, *Eudendriidae*, *Bimeridae*, and *Tubularidae*. The characteristics of these families are based upon the shape of the hydranths or polypites, and the disposition of the tentacles. Prof. Allman introduces the method of reproduction into his family characteristics, but I have thought it advisable so far as possible to retain Mr. Hincks' divisions as having characters more easily perceptible to a student. I have introduced into the text or footnotes references to Prof. Allman's families and genera wherever they differ from those of Mr. Hincks.

In the sub-order THECAPHORA, or *Calypptoblastea*, the zooids are protected by thecæ. This order contains the *Campanulariidae*, *Campanulinidae*, *Leptoscaphidae*, *Lafoëidae*, *Trichydridae*, *Coppiniidae*, *Haleciidae*, *Sertulariidae*, and *Plumulariidae*.

The sub-order GYMNOCHROA, or *Eleutheroblastea*, contains the single family *Hydridae*, in which the polyp is destitute of a polypary and is locomotive. This family comprises one genus *hydra*.

The only fresh-water hydroids are *Cordylophora lacustris* and the various species of *Hydræ*.

DESCRIPTIONS OF THE VARIOUS BRITISH HYDROIDA.

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SUB-ORDER : **ATHECATA**, *Hincks*.  
(GYMNOBLASTEA, *Allman*.)

### FAMILY I. CLAVIDÆ.

*Polypites claviform or fusiform, with scattered filiform  
tentacula.*—T. H.

Prof. Allman excludes the genus *Turris* from this order, and establishes for it the order *Turridæ*, in which the reproduction is by medusiform gonozooids. In the *Clavidæ* (Allman), which includes the remaining genera, *Clava*, *Cordylophora*, and *Tubiclava*, the reproduction is by fixed sporosacs. The diagnosis above given is sufficiently wide to include *Turris*.

#### GENUS I. CLAVA, *Gmelin*. (*Clava*, a club.)

*Polypites clavate*, contractile, rising from a filiform stolon with a chitinous polypary also investing the base of the polypites. *Tentacles* scattered, smooth, numerous. *Reproduction* by fixed sporosacs borne singly or in clusters behind the posterior tentacles.—T. H.

##### 1. C. MULTICORNIS, *Forskål*. Plate II. fig. 1.

*Tubularia affinis* (*Turt.*), *Hydra multicornis* (*Forsk.*), *Coryne squamata* (*R. Q. C.*, *V. B.*, *Fl.*), *Clava repens* (*T. S. W.*), *Clava discreta* (*All.*), *Coryne multicornis* (*Lk.*, *Tem.*, *G. J.*)

*Hab.*: Not uncommon between tide marks. Height,

$\frac{1}{4}$  in. Polypites rose or flesh-coloured, with the oral extremity white. Tentacles 30—40. Head and tentacles very motile. At the extremities of the latter are minute hairs serving as tactile organs called *palpocils*.

2. *C. SQUAMATA*, Müller. Plate II. fig. 2.

*Hydra squamata* (Mül., Fabr.), *Coryne squamata* (Lk.), *Coryne multicornis* (Ehr.), *Clava membranacea* (T. S. W., McA.), *Clava cornea* (T. S. W., T. H.).

Hab.: On *Fucus vesiculosus*; generally distributed. Height,  $\frac{1}{2}$ —1 in. Forms densely clustered colonies encrusting the fronds of the *Fucus*. Polypites yellowish-red, tall, expanding upwards, dioecious. Tentacles white, 6—20. Gonophores hanging round the body like a collar.

Dr. T. S. Wright (Edin. N. P. Journal, July, 1857), describes a smaller variety of this species under the name *C. cornea*.

3. *C. LEPTOSTYLA*, Agassiz.

Hab.: Morecambe Bay (F. H. West). Polypites forming red moss-like bunches, very tall and graceful, with not less than 35 tentacles.

For about  $\frac{1}{80}$  in. above the point of origin of the polypite it is much attenuated, and above this it increases very largely in diameter. This species has only been found once in England.

4. *C. NODOSA*, T. S. W.

Hab.: On fronds of *Delesseria sanguinea* at Queensferry and Largo, at low-tide mark (T. S. W.). Polypite single, small, aurora-coloured, springing from a knot of convoluted tubes. Described in Edin. N. P. Journ. (N.S.) xvi. 154.

5. *C. DIFFUSA*, All.

Hab.: Shetland Is. (All.). Height  $\frac{1}{4}$ — $\frac{1}{2}$  in. Poly-

pites light rose-colour. Tentacles 20. A doubtful species, probably a variety of *C. multicornis*.

Prof. Allman found it in rock-pools at low water in the Shetland Isles. It is described and figured by him (G. H. 247, Plate II. 3, 4). He considers it a separate species on account of the scattered condition of its gonophores.

GENUS II. TUBICLAVA, Allman. (*Tubus*, a tube.)

*Polypites* claviform, elevated on distinct stems arising from a creeping stolon, the whole clothed with a polypary. *Gonophores* borne on body of polypites behind posterior tentacles, or on the summit of very short stems (*Blastostyles*, Allman) developed from the stolon (*T. H.*).

This diagnosis includes the species *T. cornucopiæ*, for which Prof. Allman establishes the genus *Merona*, based on the possession by that species of blastostyles (G. H. 257).

1. *T. LUCERNA*, All.

Hab.: On loose stones, Torquay, Dublin Bay (*All.*). Height  $\frac{1}{8}$  in. Polypites very minute, polypary yellowish-brown; polypites white, with pale ochreous centre.

2. *T. FRUTICOSA*, All.

Hab.: Tenby (*All.*). Height 4—5 lines. Stem branched. Polypary smooth, straw-coloured. Polypites vermilion. Tentacles 14—18.

3. *T. CORNUCOPIÆ*, A. M. N.

*Merona cornucopiæ* (A. M. N., *All.*). Height  $\frac{1}{4}$  in. Stem consisting of trumpet-shaped tubes. Polypites with elongate claviform heads. *Gonophores* borne on short stems or atrophied polypites (*blastostyles*).

Mr. Norman and Prof. Allman refer this species to a genus *Merona*, based upon the last-named characteristic.

Mr. Norman remarks that "in every instance the Zoophyte was found at the posterior portion of shells occupied by living mollusca, where it received the benefit of the aqueous currents caused by the mollusc, which unwittingly performed the kindly office of feeding its hungry neighbour."

Hab.: Shetland (*A. M. N., C. W. P.*).

### GENUS III. TURRIS, Lesson. (*Turris*, a tower.)

*Stems* short, rooted by a filiform stolon, bearing the polypites on their summits. *Cænosarc* invested by a polypary. *Polypites* claviform, with scattered filiform tentacles. *Gonozooids* free and medusiform.—T. H.

The polypites of this genus differ from those of the other genera of the *Clavidae* in producing medusiform gonozooids. On this account Prof. Allman (*G. H.* 259) refers the genus to the family *Turridæ*, which he has established for it.

#### 1. *T. NEGLECTA*, Les, Plate II, fig. 3.

*Cyanæa coccinea* (*Davis*), *Clavula Gossii* (*T. S. W.*).

Hab.: Isle of Wight, Portland (*Forbes*), Tenby (*Davis*), Ilfracombe (*P. H. G.*), Queensferry (*T. S. W.*). Height  $\frac{1}{12}$  in. Polypites crimson, borne on short stalks. Tentacles 12, the upper row of 4 long and erect, the rest scattered, shorter, and bent upwards.

The gonozooid of this species was for a long time considered as a separate animal, and was called the "ruby medusa." Mr. Gosse, in his "Devonshire Coast," describes the medusæ as resembling beads of coral when brought up on the muslin of the net. The manubrium is large and of a dull crimson colour. The ovaries become orange-coloured, and the ova enclosed of a rich purple hue. Mr. Gosse was fortunate in

seeing the Turris in a state of ovipositing, and he observed frequently the escape of the embryos, but was not successful in rearing them to maturity. Dr. T. S. Wright, however, was subsequently able to keep the embryos until they became perfect hydroids.

GENUS IV. CORDYLOPHORA, *All.* (κορδύλη, a club, φορέω, I bear.)

*Stem* well developed, branching. *Cænosarc* entirely invested by the polypary. *Polypites* fusiform, at extremities of the branches with scattered filiform tentacula. *Reproduction* by fixed sporosacs borne on the stem.—T. H.

1. C. LACUSTRIS, *Allman.* Plate II. fig. 4.

*Syncoryne lacustris* (*Ag.*).

*Hab.*: Grand Canal Docks, Dublin (*All.*); Commercial and West India Docks, London (*Dr. Bowerbank* and *All.*); Llyn Regis (*Dr. Lowe*), &c. Height 2—3 in. *Polypites* white, ovoid, supported on a fleshy neck. Number of tentacles 12—14, which, like those of *Hydra*, can be elongated or shortened very remarkably.

*Reproduction* by ova which are developed in the gonophores to ciliated planulæ, which on their escape through the ruptured sac undergo remarkable changes in shape. They have been observed to enter upon their fixed state in a few hours.

This is the only fixed Hydroid living in fresh water. It appears to have originally flourished in brackish water, and has only very recently been known to inhabit fresh water. Prof. Carl Semper\* says, "that when he was a student it was only found in estuaries and at the mouths of rivers, where the

\* "Animal Life," 152.

water was, at any rate occasionally, salt or brackish. It was discovered almost simultaneously in England and Belgium. Since that time, 1854, the animal has in many places migrated into rivers. At one time it took possession of the great water-pipes of Hamburg in such quantities as to impede the flow of water through the pipes."

Prof. Allman,\* Van Beneden, and Dr. Schultze have exhaustively studied this species.

## FAMILY II. HYDRACTINIIDÆ.

*Polypites claviform, sessile, with a single verticil of filiform tentacles round the base of a conical proboscis borne on an expanded and continuous crust; the cœnosarc naked above.*—T. H.

GENUS I. HYDRACTINIA, Van Beneden. (*Hydra*, and *Actinia*, a sea anemone.)

Generic character contained in that of family character. *Reproduction* by means of fixed sporosacs borne usually on partially developed polypites which are destitute of tentacles, but bear clusters of thread cells around the oral extremity.—T. H.

### 1. H. ECHINATA, Fleming.

*Alcyonium echinatum* (Fl., De B.), *Alcyonidium echinatum* (G. J., R. Q. O.), *H. lactea* and *H. rosea* (V. B.), *Echinochorium clavigerum* (Has.), *Synhydra parasites* (Quatrefages), *H. polyclina* (Ag.).†

Hab.: Generally distributed on old univalve shells

\* "Gymnoblastic Hydroids."

† Mr. Hincks considers this to be the same species as *H. echinata*. Prof. Allman, though with some hesitation, considers the species distinct.



at low-water mark. Height about  $\frac{1}{2}$  in. Polypites white, with 20—30 tentacles. The proboscis capable of great change of shape. Male gonophores yellowish and pointed; female gonophores rose-coloured and rounded. Gonophores borne upon partially developed polypites. Near the edge of the colony are a number of long, filamentary processes spirally coiled when at rest, but capable of extension, as if for the purpose of defence, if any part of the colony be disturbed. These appendages of the *cœnosarc* are armed with thread cells.

On the outskirts of the colony are also distributed a number of slender extensile single tentacles.

It will be seen from the synonyms that this species was formerly considered to belong to the Polyzoa.

### FAMILY III. PODOCORYNIDÆ.

*Polypites sessile, with a single verticil of filiform tentacula round the base of a conical proboscis.*—T. H.

GENUS I. PODOCORYNE, Sars (*in part*). (*ποῦς*, a foot, and *Coryne*.)

*Polypites* correspond with family character. *Cœnosarc* consisting of a network of creeping fibres clothed with a polypary, which forms a small cup-like investment round the base of the polypite. *Gonozooid* free, medusiform.—T. H.

1. P. CARNEA, Sars. Plate II. fig. 5.

P. albida (Sars), *Hydractinia carnea* (McA.), H. echinata (Lovén).

Hab.: On *Nassa reticulata*, &c. Inch Garvie (*All.*); Torbay; Swanage Bay, Dorset; Oban (*T. H.*); Cullercoats (*Ald.*). Height about  $\frac{1}{6}$  in. Polypites tall, expanding slightly upwards, white or reddish; pro-

boscis white. Tentacles 4—30. Gonophores borne in clusters on the body of the polyp some distance below the tentacles.

Mr. Hincks has clearly made out the presence in this species of spiral and tentaculoid appendages, similar to those which are so prominent a feature of the preceding species (A. and M. of N. H., February, 1877, 150). It is curious also to notice that the shells upon which this species and *H. echinata* establish themselves are usually occupied by hermit crabs.

2. *P. AREOLATA*, *Ald.*

*Hydractinia areolata* (*Ald.*), *Rhizoclina areolata* (*All.*).

Hab.: Cullercoats (*Ald.*), Shetland (*A. M. N.*), Seaham Harbour (*Hodge*). Height  $\frac{1}{10}$  in. Polypites white, terminating in a conical mouth. Tentacles 6—10. Base of colony chitinous, set with "simple linear spines in irregular groups." Gonophores sessile, borne on the stolon and not on the polypites.

3. *P. PROBOSCIDEA*, *T. H.*

Hab.: Ilfracombe (*T. H.*). Polypite orange-brown, tall and rather stout, having a long columnar proboscis of opaque white colour. Tentacles about 14. Gonophores "forming a large collar round the polypite, a short distance below the tentacles, borne in two rows on small tubercles."

First described by Mr. Hincks in the appendix to "British Hydroid Zoophytes," p. 317.

GENUS II. *CORYNOPSIS*, *Allman*. (*κορύνη*, a club, and *ὄψις*, face.)

*Polypites* corresponding with family character, claviform, rising from a creeping stolon clothed with a polypary. *Gonozooid* medusiform.—*T. H.*

1. C. ALDERI, *Hodge*.

Podocoryne Alderi, *Hodge*.

Hab.: Seaham Harbour, Durham, on *Serpula* (*Hodge*).  
Height  $\frac{1}{4}$ — $\frac{1}{2}$  in. Polypites pale pink, gradually tapering towards the base. Tentacles 6—12.

Described by Mr. Hodge (from a specimen developed from a free medusa) in Trans. of Tyneside Nat. Field Club, v. 82.

GENUS III. CIONISTES, *T. S. W.* (*κίων*, a pillar.)

*Polypites* sessile, developed on a reticulated stolon. Reproduction by fixed sporosacs. *Gonophores* borne on rudimentary polypites.—T. H.

Prof. Allman classes this amongst the *Bimeridæ* (*Atractylidæ* of Hincks), but the polypites of that family are borne on developed stems, whereas those of *Cionistes* are sessile.

1. C. RETICULATA, *T. S. W.*

Hab.: Granton, New Edinburgh (*T. S. W.*). Polypites "minute, white, with a row of short tentacles. *Gonophores* borne on the sides of blastostyles, which, with the polypites, spring from a reticulated stolon."

Described by Dr. Wright in A. N. H., August, 1861, 123.

## FAMILY IV. HYDROLARIDÆ.

*Polypites* with a very small number of filiform tentacula springing from the base of the proboscis, but not forming a circle round it.—T. H.

This family is the "*Laridæ*" of Hincks, a name not admissible, having been previously applied to a family of birds.

GENUS *LAR*, *Gosse*. (*Lar*, a household god.)

*Polypites* fusiform, sessile; two tentacula developed on a creeping and anastomosing filiform stolon.—  
P. H. G.

1. *L. SABELLARUM*, *P. H. G.* Plate III. fig. 1.

This species was first observed by Mr. Gosse on the tube of a *Sabella* in his aquarium. The appearance of the polypites is "ridiculously like that of a minute doll," and, according to Mr. Gosse's description, it closely imitates certain human motions and incessantly bows and tosses its arms in an energetic manner. Mr. Gosse's account is as follows: "A slender creeping thread, irregularly crossing and anastomosing so as to form a loose network of about three meshes in width, surrounds the margin of the *Sabella's* tube, adhering firmly to its exterior surface, in the chitinous substance of which it seems imbedded. Here and there free buds are given off, especially from the lower edge, while from the upper threads spring the strange forms that have attracted our attention. These are spindle-shaped bodies, about one-fortieth of an inch in height, whose lower extremities are of no greater thickness than the thread from which they spring, with a head-like lobe at the summit, separated from the body by a constriction, immediately below which two lengthened arms project in a direction towards the axis of the tube. The motions of the polyps are not rhythmical, but each individual appears to be animated by a distinct volition. The head lobe encloses a central cavity, and the arms are hollow with thick walls. Examined with a power of 560 diameters, the arms are seen to be formed of globose cells made slightly polyhedral by

mutual pressure, set in single series." Mr. Gosse states that he saw one of them open the head lobe and unfold it in the form of a broad shovel-shaped expanded disc. This form was first discovered by Mr. Gosse in 1855, and was not observed afterwards till 1872, when it came under the notice of Mr. Hincks. Mr. Gosse published a memoir on it in the Trans. Linn. Soc., xx. 113; and Mr. Hincks published a paper on it in the A. and M. of N. H., November, 1872.

#### FAMILY V. CORYNIDÆ.

*Polypites with capitate tentacula scattered or in several whorls.*—T. H.

Prof. Allman, who, as before stated, bases the characteristics of his families upon the method of reproduction as well as the appearance of the polypite, divides the *Corynidæ* of Hincks into two families, namely, *Corynidæ*, comprising the genus *Coryne*, in which the reproduction is by fixed sporosacs, and *Syncorynidæ*, comprising the genera *Syncoryne*, *Gymnocoryne*, and *Zanclea*, in which reproduction is by free medusæ.

##### GENUS I. CORYNE, Gaertner. (*κορύνη*, a club.)

*Stem* simple or branched, rooted by a creeping filiform stolon, the whole sheathed in a thin chitinous tube smoothed or annulated. *Polypites* terminal, with tentacles as described above. *Reproduction* by fixed sporosacs on the body of the polypite.—T. H.

##### 1. C. PUSILLA, Gaertner. Plate III. fig. 2.

*Syncoryne pusilla* (Ehr.), *Syncoryna Listerii* (V. B.), *C. glandulosa* (Dal., Lk.), *C. ramosa* (Ald.), *C. sessilis*

(*P. H. G.*),\* *Hermia glandulosa* (*G. J.*), *Tubularia coryna* (*Gmel., Lin.*).

Hab.: Scotland (*Dal.*), Tynemouth (*Howse*), Filey, Ilfracombe, Torquay, Hastings (*T. H.*), Bangor (*A. S. P.*). Height 1 in. Stem annulated, dark horn colour. Polypites reddish colour, tapering very slightly. Tentacles very numerous, 30 at least, irregularly arranged and ending in capitula, which are very large and armed with thread cells.

The young of this species is described by Gosse, in his "Devonshire Coast," under the name "*Coryne sessilis*" or the sessile Coryne. He describes the polyps as about  $\frac{1}{16}$  in. high. He counted as many as 45 tentacles on one head arranged in about six whorls.

Mr. Gosse also describes a variety in which the investing tube was gelatinous. In this case in a few days the specimen shrunk into a shapeless club with all the tentacles agglutinated in a mass round the body. There is a considerable difference of opinion amongst naturalists as to the identity of the species referred to this genus.

2. *C. VAGINATA*, *Hincks.*

*C. ramosa* (*G. J.*, *P. H. G.*, *Ald.*, *McA.*), *Coryne* (*List*).

Hab.: Ilfracombe, Swanage, Clew Bay (*T. H.*); Cork (*All.*); Channel Islands. Height 3 or 4 in. Polypary branched, annulated and horny, except the last three or four rings which protect the neck of the polypite, and are membranous. Stem yellowish-brown and so transparent as to admit of an examination of the

\* Prof. Allman treats this provisionally as a distinct species, and not as a synonym of *C. pusilla* (*G. H.* 271).



structure of the cœnosarc. Polypite fusiform, tapering towards the neck and mouth; colour white, with a centre of reddish-brown. Tentacles 15—30, tipped with red or rose colour, and arranged in 4 or 5 somewhat indistinct whorls. They are mobile, but when at rest are either at right angles to the body or curved inwards. Ova large.

Mr. Gosse (Dev. Coast) describes the polypite every graphically, and states that he has seen as many as 25 ova expelled from one gonophore in a minute. The ova exhibited amœboid movements after expulsion.

3. *C. VERMICULARIS*, *T. H.*

Hab.: Shetland, in deep sea zone (*T. H.*). Height  $\frac{3}{4}$  in. Polypite large worm-like, and growing in shrubby tufts. Tentacles about 25, with large capitula, arranged in whorls with considerable distances between the rows. Stem only slightly ringed.

4. *C. FRUTICOSA*, *T. H.*

Hab.: Exmouth, Mounts Bay (*T. H.*); Herm, on *fucus* (*Hodge*). Height  $1\frac{1}{2}$  in. Polypite delicate, growing in dense bushes. Stems distinctly annulated and more or less transparent. Tentacles 20.

Prof. Allman is disposed to regard this as a variety of *C. pusilla*.

5. *C. VAN BENEDENI*.

Described by Van Beneden under the name of *Syncoryne pusilla*. This is given by Mr. Hincks as an English species upon the authority of a figure drawn by Dr. Johnston from British specimens, but no British habitat is known, and Prof. Allman treats it as a foreign species under the name *Actigonium pusillum*.

6. *C. NUTANS* (?), *Allman*.

Hab.: Barraforth Caves, Shetland (*A.M.N.*). Height  $\frac{1}{2}$  in.

This is the name given provisionally by Prof. Allman to some specimens obtained by Mr. Norman, and preserved in spirits, which did not show the reproductive organs (*Allman*, G. H., 271).

GENUS II. *SYNCORYNE*, *Ehrenberg* (*in part*).

*Stem*, *polypite*, and *tentacles* as *Coryne*. *Gonophores* borne on the body of the polypite, and containing medusiform zooids, having (at the time of liberation) a bell-shaped or globular umbrella and four marginal tentacles springing from ocellated bulbs.—T. H.

The distinction between this genus and the preceding is, therefore, that this genus is reproduced by medusiform gonozooids. The differences between the gonozooids of the different species at the time of liberation are very slight.

1. *S. EXIMIA*, *All.*

*Coryne eximia* (*All.*, *McA.*); *C. Listerii* (*Ald.*).

Hab.: Along the north-eastern coast, where it is the common species of the genus. Height 3 to 4 in. Stems straw-coloured and transparent, smooth, except just above the points of branching, where the branches are ringed; branchlets mostly developed on one side of the branch. The polypites are pale pink, with 20–30 tentacles scattered, except 4 at the distal end.

2. *S. Sarsii*, *Løvén*.

*S. ramosa* (*Løvén*), *S. Lovenii* (*Sars*),\* *Coryne Sarsii* (*McA.*).

\* Prof. Allman treats this as a separate species, not included amongst the British fauna (G. H., 276).



Hab.: Firth of Forth, Durham. Height  $\frac{1}{2}$  in. Stems slender, sparingly branched and indistinctly annulated. Polypites pale rose colour. 12—16 tentacles. Gonophores developed among the tentacles.

3. *S. GRAVATA*, *T. S. W.*

*Coryne gravata* (*T. S. W.*, *McA.*), *Sarsia* and *Coryne mirabilis* (*Ag.*),\* *Tubularia stellifera* (*Couth.*)

Hab.: North Berwick, Filey Brigg. Height  $\frac{1}{4}$  in. Stem smooth and slender. Polypites colourless, small, with 10—12 short tentacles. A peculiarity about them is that the heads of the polypites often disappear, leaving the stalk with one or two medusiform gonozooids.

On Plate X. of Hincks' "British Hydroid Zoophytes," are figured the different forms and stages of this species, which show the atrophied forms of the polypites very distinctly.

This species has been very fully investigated by Agassiz, both in its complete form and its embryo stages.

4. *S. DECIPIENS*, *Duj.*

? *Laomedea pulchella* (*McA.*)

Hab.: Firth of Forth (*T. S. W.*).

This is a species little known. The peculiarities of the polypite are the possession of a prominent trumpet-shaped proboscis and the small number, 8 or 9, of its tentacles. Prof. Allman, however, excludes this from the British species.

5. *S. PULCHELLA*, *All.*

Hab.: Skelmorlie, Firth of Clyde (*All.*). Height  $\frac{1}{2}$  in. Polypite deep orange. Tentacles 15—20.

This species is described by its discoverer, Prof.

\* Prof. Allman treats this as a separate species, not included amongst the British fauna (*G. H.*, 278).

Allman, as being allied to the preceding species, but being more ovate in form and having more numerous tentacles.

6. *S. FEROX*, *T. S. W.*

Hab.: Firth of Forth (*T. S. W.*).

This species is described by Dr. Wright in the *Journal of Anat. and Physiol.*, i. 335. It is nearly allied to *S. decipiens*, and is not improbably identical with the *S. pulchella* of Allman.

7. *S. FRUTESCENS*, *All.*

Hab.: Kingston, Dublin (*All.*). Height 1—2 in. Polypite light pink, oval. Tentacles 14.

Described by Prof. Allman in *G. H.*, 281.

### GENUS III. *ZANCLEA*, *Gegenbaur.\**

As *Syncoryne*, except that the umbrella of the free gonozooid is nearly spherical at the time of liberation, and the marginal tentacles are two, springing from non-ocellated bulbs.—*T. H.*

1. *Z. implexa*, *Ald.*

*Tubularia implexa* (*Ald.*), *Coryne implexa* (*Ald.*, *T. S. W.*, *McA.*), *Coryne pelagica* (*Ald.*), *C. Briareus* (*All.*), *Gemmaria implexa* (*All.*).

Hab.; Holy Isl., Northumberland (*Howse*); Cullercoats (*Ald.*); Seaham (*Hodge*); Inch Garvie (*T. S. W.*); Firth of Forth (*All.*). Height  $\frac{1}{2}$ — $\frac{3}{4}$  in. Polypites white, with gastric cavity pale pink, growing in tangled masses. Polypary composed of two coats, an inner horny annulated one, extending only a short distance

\* Prof. Allman refers *Z. inflexa* to the genus *Gemmaria*. Mr. Hincks considers the two genera, *Zanclaea* and *Gemmaria*, to be identical.

from the stolon, and an outer membranous one. Tentacles number 40—50, set in imperfect rows.

Prof. Allman, in his "Notes on the Hydroida," in Annals of Nat. Hist., July, 1864, describes fully the structure of the tentacles, which are very small.

#### GENUS IV. GYMNOCORYNE, *Hincks*.

*Polypites* sessile, on a creeping filiform stolon invested with a chitinous polypary. Tentacles numerous, the distal ones in a verticil round a conical proboscis, the others scattered over the body. Reproduction unknown.—T. H.

##### 1. G. CORONATA, *T. H.*

Hab.: Salcombe Bay (*T. H.*). Polypite very minute, body reddish, proboscis white, with 40 or more tentacles, of which 8 or 9 at the distal end are thicker, have larger capitula, and form a verticil.

Described by Mr. Hincks in Annals of N. H., August, 1871.

#### FAMILY VI. PENNARIIDÆ.

*Polypites clavate or subcylindrical, with two kinds of tentacles, one kind capitate and disposed in one or more verticils, the other filiform and without capitula.*

I have altered the diagnosis of this family so as to include all the genera *Cladonema*, *Stauridium*, *Vorticlava*, and *Acharadria*. Prof. Allman places *Cladonema* in a distinct family, which he calls *Cladonemidæ*, and ranks the three other genera amongst the *Pennariidæ*. Mr. Hincks places *Cladonema* and *Stauridium* in the family *Stauridiidæ*, and *Vorticlava* and *Acharadria* amongst the *Pennariidæ*. His reason for separating

them is that he considers the proximal filiform tentacles in *Stauridium* and *Cladonema*, which he describes as rigid in the species belonging to these genera, to be merely tactile organs, and not tentacular in function. Prof. Allman, however, describes the proximal tentacles of *Cladonema* not as rigid but as "less contractile than the distal ones." I have, therefore, extended the diagnosis of the family so as to include all the genera.

#### GENUS I. CLADONEMA, Dujardin.

*Stems* simple or branched, rooted by a creeping filiform stolon, the whole invested by a polypary. *Polypites* clavate, borne on the summit of the stems and branches. *Tentacles* arranged in single verticils in the form of two crosses, the proximal tentacles only slightly mobile without capitula, covered towards the extremity with palpcils. *Gonophores* on the body of the polypite originating free medusiform zooids. *Gonozooid* bell-shaped, with 8—10 radiating canals.

Mr. Saville Kent ("Infusoria," 264) has given the name *Cladonema* to a genus of Infusoria, but as the name was given to this genus of Hydroids by Dujardin so long ago as 1843, it clearly belongs to it of right, and should stand.

##### 1. C. RADIATUM, Dujardin.

Coryne Stauridia (P. H. G., McA.), Stauridie (Duj.).

Hab.: Devonshire (P. H. G.); Zoological Gardens in tanks, Kent (Dowker). Height  $\frac{1}{2}$ —1 in. Stem smooth, slender and creeping, light yellowish-brown in colour. Polypite pale red. Tentacles arranged in two cruciform verticils, 4 in each. The proximal ones capitate and longer than the distal ones, which are filiform and only slightly, if at all, mobile.

This species has been observed and described by many naturalists, from Dujardin (1843) to the present time.

Mr. Gosse describes it, under the name of the *Slender Coryne*, as "creeping irregularly in the form of a white thread about the same thickness as a human hair. This thread is cylindrical and tubular, perfectly hyaline and without any vestige of rings or wrinkles. The thread is very long in proportion to its thickness, and here and there starts from its support and sends off free branches, the ramification generally forming an acute angle, and continuing of the same form, structure, and thickness as before. The polyp appears to be a clavate enlargement of the branch, no open end of an investing tube being visible in any part of the zoophyte. The head is transparent, slightly tinged with yellow, corrugated with coarse annulations. The form of the polyp reminds one of a familiar kind of turnstile, or one of those presses the screw of which carries arms loaded at their extremities with globes of metal, to increase their impetus when turned." The appearance described by Mr. Gosse is caused by the 4 capitate tentacles arranged like the arms of a cross round the head. These tentacles are covered with small tubercles bearing palpocils. At the opposite extremity of the body, 4 false tentacles are placed at right angles round the polypite. These are rounded and serve as tactile organs. Mr. Hincks states that Mr. E. W. H. Holdsworth succeeded in keeping alive several specimens of the free gonozoid obtained from the tanks in the Zoological Gardens, so as to trace almost the entire course of the reproductive history.

Prof. Allman, also, has carefully studied the anatomy

and development of this species, and has noted his researches in his "Gymnoblastic Hydroids," p. 216. He describes it as the first species "in which the entire life-series was followed through the complete succession of polypite, medusa, and planula, and back again to the polypite."

GENUS II. STAURIDIUM, *Dujardin*.

*Stems* as in last genus. *Polypites* subcylindrical, with several verticils of capitate tentacula arranged in the form of a cross. Also a row of proximal rigid *tentacles*.\* *Gonozooid* has 4 radiating canals.—T. H.

1. S. PRODUCTUM, *T. S. W.* Plate III. fig. 3.

*Stauridia producta* (*T. S. W.*), *Coryne Cerberus* (*P. H. G., McA.*).

*Hab.*: Ilfracombe (*T. H.*), Firth of Forth (*T. S. W.*), Penzance (*All.*). Height  $\frac{1}{2}$  in. *Polypites* white, cylindrical, with 12 capitate tentacles disposed in three cruciform equidistant rows. Proximal tentacles rigid, tapering to a blunt point. The capitate tentacles increase from 2—12 according to age.

Mr. Gosse, under the name of the "three-headed *Coryne*," describes an immature specimen of this species.† The body of the polypite is stated by him to be very mobile, and the mouth is capable of being used as a sucker.

GENUS III. VORTICLAVA, *Ald.*

*Polypites* borne on simple stems, developed at intervals on a creeping filiform stolon, destitute of a continuous polypary. *Tentacles* in two dissimilar ver-

\* Mr. Hincks calls these "false tentacles."

† "Devonshire Coast," p. 222.



## FAMILY VIII. MYRIOTHELIDÆ, Sars.

*Polypites* single, with very many minute capitate tentacula scattered over the body.—T. H.

GENUS MYRIOTHELA, Sars. (μύριος, innumerable, θηλή, a nipple.)

*Polypites* solitary, cylindrical, terminating in a conical proboscis. *Tentacles* very small, capitate, covering the greater portion of the body.—T. H.

M. COCKSII, Vigurs. Plate III. fig. 4.

Arum Cocksii (Vigurs), Spadix purpurea (P. H. G.), Candelabrum arcticum (Ag.), M. arctica (All.), M. Phrygia (All., T. H.).

Hab.: Falmouth (Mr. Cocks), Devonshire Coast (T. H., P. H. G.). Height, 1 to 2 in. when extended. *Polypites* nearly cylindrical, terminating in a conical proboscis. *Tentacles* capitate, tipped with red, densely crowded, covering about three-fourths of the body. *Gonophores* spherical, borne below the tentacles on short processes; said by Mr. Hincks to be coryniform (*blastostyles*), but in Prof. Allman's opinion peduncles.

In the tentacles Prof. Allman discovered the curious sense-organs referred to in the preceding descriptive chapter.

This species has until recently been considered identical with the *Lucernaria Phrygia* of Fabricius (the *Myriothela arctica* of M. Sars), but Mr. G. O. Sars has shown that that species is distinct from the British one, and therefore the name given by Mr. Vigurs must be restored (Hincks, A. and M. N. H., 4th ser., xiii. 136).

FAMILY IX. EUDENDRIIDÆ. (εὖ, well, and  
δένδρον, a tree.)

*Polypites borne on a well-developed stem, with a simple verticil of filiform tentacula surrounding the base of a large trumpet-shaped proboscis.\*—T. H.*

GENUS EUDENDRIUM, Ehr. (in part).

*Stem branched, rooted by a creeping filiform stolon, the whole invested by a chitinous polypary. Polypites vase-shaped or roundish, and as in family character. Gonophores on body below tentacles, or from stem containing fixed sporosacs.—T. H.*

1. E. RAMEUM, Pallas.

*Tubularia ramea (Pal., G. J., Dal., R. Q. C., Bosc), Thoa Savigni (Lamæ.), Tubularia ramosa (G. J.).*

*Hab. : Shetland, East Coast of England, Scotland, and Ireland, Whitburn, Whitehaven ; rare in Cornwall, Lytham, St. Andrew's (McI.). Height 3—6 in. Stem much branched. Main stem reddish-brown, often  $\frac{1}{4}$  in. in thickness, and with the principal branches composed of a bundle of tubes. Branchlets alternate; slightly ringed at the joints. Polypites rose colour, with vase-shaped proboscis (hypostome) and about 20 tentacles. Gonophores borne as described in generic character.*

*This beautiful species has been a favourite of all zoophytologists. Its tree-like appearance and habit are such as to amply justify its generic name.*

*The usual height is 6 inches, but a height of 9 inches is sometimes attained. The following poetical descrip-*

*\* "With the hypostome abruptly differentiated from the body" (All., G. H., 330).*



tion by Sir J. G. Dalyell\* has often been quoted as showing the singular beauty and tree-like appearance of this species:—

“This is a splendid animal production—one of the most singular, beautiful, and interesting among the boundless works of nature. Sometimes it resembles an aged tree blighted amidst the war of the elements, or withered by the deep corrosions of time; sometimes it resembles a vigorous flowering shrub in miniature, rising with a dark brown stem, and diverging into numerous boughs, branches, and twigs, terminating in so many hydræ, wherein red and yellow intermixed afford a fine contrast to the whole. The glowing colours of the one, and the venerable aspect of the other—their intricate parts often laden with prolific fruit, and their numberless tenants, all highly picturesque—are equally calculated to attract our admiration to the creative power displayed throughout the universe; and to sanction the character of this product as one of uncommon interest and beauty.”

Mr. McIntosh has found specimens at St. Andrew's, 9 in. high with a breadth of 8 in.

2. *E. RAMOSUM*, Linn. Plate III. fig. 5.

*Tubularia ramosa* (Linn., Lk., Lamæ., E. and S., Berk., Turt., Stew., Bosc, Flem., Hogg, Stark, Temp., De B., G. J., R. Q. C.), ? *Sertularia racemosa* (Cav.), *Tubularia trichoides* (Pal., De B.), *Fistularia ramosa* (Müll.), *Fistulana ramosa* (Fabr.).

Hab.: generally distributed. Height 4–6 in. Stem reddish-brown to black, much branched, branches ringed at origin. Polypite vermilion; about 20 white tentacles. Some of the polypites are armed with a

\* “Rem. An. of Scotland,” i. 50.

curious organ about as thick as three or four tentacles, which is long and club-shaped, and crowned with cnidæ towards the extremity. Dr. Weisman was the first to observe this organ (A. and M. of Nat. Hist., ser. 5, vol. ix. p. 201). I have myself found it upon the polypites of this species. Its purpose is very doubtful, as it is only found upon a few of the polypites in a colony. It is evidently, however, a defensive weapon of considerable power.

This species was described by Ellis\* under the name of the "small ramified tubular coralline." He found it upon the Kentish coast. It was one of the species which demonstrated to him the animal nature of the zoophytes. He states that "here the curious naturalist may plainly discover a polyp branching out like the common fresh-water one of Mr. Trembiey's, but strongly fortified by nature to support itself in its turbulent situation; for he will observe this is defended by a tough horny covering, and fixed by its base to solid bodies in the sea, to secure itself from the infinite number of enemies that every moment surround it."

3. *E. ANNULATUM*, *Norman*.

Height 4 in. Stem much branched, horn colour. Polypites with 16—20 tentacles.

This species was discovered by the Rev. A. M. Norman in "Buness Hall," a cave in Shetland. It is described by Mr. Norman in an article on "Undescribed British Hydrozoa, &c.," in the An. of Nat. Hist. for January, 1864, p. 83.

4. *E. ARBUSCULA*, *T. S. W.*

Height 2 in. Stem dark horn colour, much branched.

\* Ellis, "Corallines," 31.

Polypites white, "with numerous alternate tentacles, base of body surrounded by a ring of thread cells."

Described by Dr. Wright from a single specimen obtained at Queensferry, in the *Edin. N. P. Journal*, July, 1859, p. 113.

5. *E. CAPILLARE*, *Alder*.

*Corymbogonium capillare* (*All.*), *Dicoryne capillare* (*Ald.*).

Hab.: Plymouth (*Ald.*), Northumberland (*Embleton*), Firth of Forth (*All.*), St. Andrew's (*McI.*), Cornwall (*T. H.*). Height  $\frac{1}{2}$ — $\frac{3}{4}$  in. Polypites greyish-olive, vase-shaped, with from 20—30 long tentacles. Stem branched irregularly. Branches of equal thickness with the stem, and ringed above the point of branching.

6. *E. VAGINATUM*, *All.*

Hab.: Shetland, on the "Out Skerries" (*All.*). Height  $1\frac{1}{4}$  in. Polypary deeply ringed. Polypites vermilion, with 18 tentacles.

Described by Prof. Allman in *An. N. H.*, January, 1863.

7. *E. INSIGNE*, *T. H.*

*E. humile* (*All.*).

Hab.: Torquay (*All.*), Ilfracombe, Swanage (*T. H.*). Height  $\frac{1}{4}$ — $\frac{3}{4}$  in. Polypary delicate, reddish-brown, ringed throughout. Polypite yellowish-vermilion, very graceful and beautiful. Tentacles 20—23.

## FAMILY X. BIMERIDÆ.

*Polypites borne on a stem with a single wreath of filiform tentacula surrounding a conical proboscis.*

The name given originally to this family was *Atrac-*

*tylidæ*, from the genus *Atractylis*, Wright. *Atractylis* being in use as a botanical generic name must be suppressed, and Prof. Allman has, in his "Gymnoblastic Hydroids," given the name *Wrightia* to the genus formerly called *Atractylis*, and has called the family *Bimeridæ*. The *Bimeridæ* of Allman is not, however, coincident with the *Atractylidæ* of Hincks, as the former excludes the genera *Dicoryne*, *Bougainvillea*, and *Perigonimus*. For the first of these, the species of which possess natatory sporosacs, he has instituted the family *Dicorynidæ*; the other two he has placed in a family *Bougainvillidæ*, one of the characteristics of which is that the hypostome or proboscis is continuous with the body of the polypite. By adhering to the rule before laid down, of confining the family characteristics to the shape of body and shape and disposition of tentacles, the whole of the genera included in the family *Atractylidæ* of Hincks will come within the diagnosis of the family *Bimeridæ*.

#### GENUS I. WRIGHTIA, All.

(Named after Dr. T. S. Wright.)

*Cœnosarc* sheathed in a chitinous polypary. *Stems* erect, funnel-shaped, developed at intervals on a creeping stolon. *Polypites* emerging from the summits of the stems, into which they are retractile, fusiform, with single verticil of filiform tentacles. *Reproduction* by fixed sporosacs borne on the side of the stem, and invested by a chitinous envelope.—T. H.

##### 1. W. ARENOSA, Ald.

*Atractylis arenosa* (Ald., T. S. W., T. H.).

Hab.: Tynemouth, Cullercoats (Ald.), Largo (T. S. W.), Filey Brigg (T. H.). Stems minute, funnel-

shaped, covered with grains of sand or mud, hence the specific name. Polypite entirely retractile, white, with about 12 long tentacles alternately elevated and depressed.

GENUS II. PERIGONIMUS, Sars. (*περί*, all round, *γόνιμος*, fruit-bearing.)

As last genus, except that the reproduction is by gonophores springing from the *cœnosarc*, and developing free swimming medusiform gonozooids.—T. H.

This genus Prof. Allman places in his family *Bougainvillidæ*.

1. P. REPENS, T. S. W.

*Eudendrium pusillum* (T. S. W.), *Atractylis repens* (T. S. W., Ald., McA.), *P. pusillus* (All.).

Hab.: Firth of Forth (T. S. W.), Cullercoats (Ald.), Shetland (All.), Ilfracombe (T. H.). Height  $\frac{1}{2}$ — $\frac{1}{4}$  in. Stem terminating in a cup-shaped expansion. Polypites white, clavate, partially retractile, with 4—12 alternately elevated and depressed tentacles.

2. P. MINUTUS, All.

Hab.: Shetland (All.). Height  $\frac{1}{2}$  in. Stem simple, smooth. Polypite ash-brown, "with 7 or 8, rarely 12 tentacles, which are held straight but very irregularly in distension" (All.).

This species is considered by Mr. Hincks to be identical with the preceding, but Prof. Allman holds it to be distinct. He obtained it from the operculum of living *Turritellas* in Busta Voe, Shetland.

3. P. SESSILIS, T. S. W.

*Eudendrium sessile* (T. S. W.), *Atractylis sessilis* (T. S. W.).

Hab.: Firth of Forth (T. S. W.). Stems short and

ringed or obsolete, a membranous extension of the polypary reaching to the tentacle of the polypite. Polypite red or white, with 8 equal tentacles.

4. *P. PALLIATUS*, *T. S. W.*

*Atractylis palliatus* (*T. S. W.*).

Hab.: Granton (*T. S. W.*). Body of polypite clothed with a gelatinous envelope. Polypite small, white, with 8 alternate tentacles.

Described by Dr. Wright (*Annals of Nat. Hist.*, August, 1861, p. 129), who states that the polypites surrounded by their gelatinous envelopes resembled a mass of minute ova.

5. *P. VESTITUS*, *All.*

Hab.: Firth of Forth (*All.*). Height about  $\frac{1}{6}$  in. Stems simple or slightly branched, yellowish-brown, "roughened by adherent particles of sand." Polypites pale yellow, with 6—10 tentacles. A continuation of the polypary "extends as a delicate smooth membrane over the body nearly as far as the mouth."

6. *P. SERPENS*, *All.*

Hab.: Torbay (*All.*), Ilfracombe, Filey Brigg (*T. H.*). Height  $\frac{1}{8}$  in. Stem short, simple, with smooth transparent polypary. Polypite reddish-orange. Tentacles 12—14.

Mr. Hincks describes this as a "brilliant little zoophyte." It was first described by Prof. Allman in "Notes on the Hydroida," *Annals of N. H.*, January 1863. He found it on the stems of *P. setacea*, dredged from 12 fathoms depth.

*Doubtful Species.*

7. *P. (?) LINEARIS*, *Ald.*, Suppl. North. Cat. Trans. Tyne F. C., v. 230.

*Atractylis linearis* (*Ald.*).

Hab.: Cullercoats (*Ald.*).

8. P. (?) *MINIATUS*, *Wright*, Micro. Journal (N. S.),  
iii. 48.

*Atractylis miniatus* (*T. S. W.*).

Hab.: Largo, Granton.

9. P. (?) *COCCINEUS*, *T. S. W.*, Ann. N. H., August,  
1861.

*Atractylis coccineus* (*T. S. W.*).

Hab.: Inch Garvie (*Wright*).

10. P. (?) *BITENTACULATUS*, *Wright*, Journ. Anat. and  
Physiol., i. 334.

*Atractylis bitentaculata* (*T. S. W.*).

Hab.: Firth of Forth (*T. S. W.*).

11. P. (?) *QUADBITENTACULATUS*, *Wright*, ubi sup.

*Atractylis quadritentaculata* (*T. S. W.*).

Hab.: Firth of Forth.

The two last-named species are regarded by Prof.  
Allman as probably immature forms of some species of  
*Perigonimus*.

12. P. (?) *NUTANS* (*T. H.*).

Described by Mr. Hincks in Ann. Nat. H., February,  
1877.

GENUS III. *HYDRANTHEA*, *Hincks*. (*Hydra*, and *ἄνθος*,  
a flower.)

*Stems* very short, rising at intervals from a network  
of tubes, the whole invested with a polypary. *Poly-*  
*pites* borne singly on the stems, elongate, spindle-  
shaped. *Tentacles* as in last genus, but each alternate  
one bearing a prominent tubercle composed of large  
bean-shaped thread cells. *Gonophores* large, containing  
fixed sporosacs.—T. H.

1. *H. MARGARICA*, *Hincks*.*Atractylis margarica* (*T. H.*).

*Hab.*: Ilfracombe, on *F. foliacea*, abundant. Polypites white tinged with yellow, with about 30 tentacles webbed at the base, alternately elevated and depressed, each of the latter tentacles bearing a number of bean-shaped thread cells, on its lower side forming "a girdle of pearls round the base of the tentacular ring."

GENUS IV. *GARVEIA*, *T. S. Wright*.

*Stems* compound and branched—rooted by a filiform stolon and invested by a polypary. *Polypites* fusiform. *Tentacles* filiform, in a single verticil. *Gonophores* borne on branchlets, producing fixed sporosacs.—*T. H.*

1. *G. NUTANS*, *T. S. W.* Plate III. fig. 6.*Eudendrium* (*Corythamnium*) *bacciferum* (*All.*).

*Hab.*: Inch Garvie (*T. S. W.*), Firth of Forth and Morecambe Bay (*All.*), Shetland (*T. H.*). Height 1 in. Stem reddish-brown, orange towards tips, slightly corrugated, much branched and fascicled. Polypary continued over the base of the polypite, where it forms a cup-like expansion. Polypite orange-red, with 10 tentacles. *Gonophores* borne like polypites at the extremities of branchlets.

The name *nutans* is derived from the fact, noticed by Dr. Wright, that "when irritated the zoophyte bends all its polyps downwards, like flowers drooping on their stalks."

GENUS V. *BIMERIA*, *T. S. Wright*.

*Stems* branched, rooted by a thread-like stolon, all enclosed in a chitinous polypary. *Polypites* vase-shaped, with a single verticil of filiform tentacles, the



body and the lower part of each tentacle clothed in an opaque brown membrane. *Gonophores* producing fixed sporosacs.—T. H.

1. *B. VESTITA*, T. S. W.

*Manicella fusca* (All.).

Hab.: North Queensferry and Inch Garvie (T. S. W.), Firth of Forth (All.), Whitby, Torbay, and Salcombe (T. H.). Height  $\frac{1}{2}$  in. Stem slender, branched. Polypary "rendered opaque by the accumulation of earthy particles and sand," continuing almost to the extremity of the proboscis, and forming a sheath round the lower part of each tentacle. The colour is dull brown throughout. Polypites with 16 tentacles.

GENUS VI. DICORYNE, All. (δῖς, double, κορυνή, a club.)

*Stem* branched or simple, rising from a creeping filiform stolon, all invested by a polypary. *Polypites* fusiform, with a single verticil of filiform tentacles. *Gonophores* borne on rudimentary polypites without tentacles, and producing natatory gonozooids.—T. H.

Prof. Allman refers this genus to a separate family, *Dicorynidae*.

1. *D. CONFERTA*, Ald.

*Eudendrium confertum* (Ald.), *Dicoryne stricta* (All.).

Hab.: Cullercoats (Ald.), Orkney (All.), Shetland (A. M. N.). Height  $\frac{1}{2}$  in. Stem opaque, earthy brown, much branched, strongly annulated. Alimentary polypites ash-brown or flesh-coloured, with about 16 tentacles. The gonophores borne on blastostyles or immature polypites, and producing free gonozooids, which are oval, pointed at one end and expanded at

the other, ciliated all over, and bear two tentacles at the broad end.

This gonozoid is described by Mr. Hincks as intermediate between the fixed gonozoid and the medusoid form,—the tentacles representing the usual swimming organs, and the ciliary action replacing the pulsations of the swimming-bell.

GENUS VII. HETEROCORDYLE, *All.* (*ἑτερος*, dissimilar, *κορδύλη*, a club.)

As last genus, except that the *gonophores* develop fixed sporosacs.—T. H.

1. H. CONYBEARI, *All.*

Hab.: Glengariff, co. Cork (*All.*), Oban (*T. H.*).  
Height  $\frac{1}{2}$  in.

This species, described by Prof. Allman in the *Annals of Nat. Hist.* for July, 1864, resembles *D. conferta*, from which it is mainly distinguished by its smaller growth and fixed sporosacs.

GENUS VIII. BOUGAINVILLIA, *Lesson.*

(Named after a French traveller, Admiral Bougainville.)

*Stem* branched, rooted by a filiform stolon, the *cœnosarc* enclosed in a polypary. *Polypites* and *tentacles* as in last genus. *Gonophores* developed from the branches, and originating free zooids.—T. H.

This genus, with *Perigonimus*, is referred to a family *Bougainvillidæ* by Prof. Allman, who states that the polypites are distinguished from those of *Eudendriidæ* by "not having the hypostome abruptly differentiated."

This feature Prof. Allman makes a family characteristic of the *Bougainvillidae*.

1. *B. RAMOSA*, *Van Beneden*.

*Eudendrium ramosum* (*V. B.*), *Tubularia ramosa* (*Dal.*), *Medusa Oculia* and *duodecilia* (*Daly*), *Atractylis ramosa* (*T. S. W.* and *McA.*), *Margelis ramosa* (*Ag.*).

Hab.: Queensferry (*T. S. W.*), Oban, Torbay (*T. H.*), Northumberland (*Ald.*), Devonshire Coast (*All.*). Height 1—3 in. Stem straw colour, much branched. Polypites pale pink, with 12—20 white tentacles. Gonophores borne on the branchlets on long peduncles.

This species is not unlike *Halecium* in appearance (*Ald.*). The polypite when retracted is almost concealed by a cup in which the polypite-bearing branchlets terminate.

2. *B. FRUTICOSA*, *All.*

*Eudendrium ramosum* (*All.*, *A. N. H.*, July, 1864).

Hab.: Kenmare River, co. Kerry, and Firth of Forth (*All.*). Height 2 in.

This species very much resembles the preceding. It is, however, more slender, and the body of the polypite is not so completely retractile into the protective extension of the polypary.

3. *B. MUSCUS*, *All.*

*Perigonimus muscus* (*All.*).

Hab.: Torquay (*All.*). Height  $\frac{1}{2}$  in. Stem consisting of a simple tube, light yellowish-brown in colour, and with the polypary slightly wrinkled. Polypites light reddish-brown, with about 16 tentacles.

This zoophyte somewhat resembles *B. ramosa*, from which, however, its small size and simple ramification readily distinguish it.

## FAMILY XI. TUBULARIIDÆ.

*Polypites* flask-shaped or subcylindrical, with two sets of filiform tentacula, one oval, the other placed near the base of the body.—T. H.

The family *Tubulariidæ* of Hincks includes the three genera, *Tubularia*, *Ectopleura*, and *Corymorpha*, all of which conform to the diagnosis above set forth. Prof. Allman, however, divides these three genera among three families, and divides the genus *Corymorpha* into two genera. The following shows Prof. Allman's families and genera :—

Reproduction by fixed sporosacs — *Tubulariidæ* ; genus *Tubularia*.

Reproduction by medusiform gonozooids, and having a polypary—*Hydocrinidæ* ; genus *Ectopleura*.

Reproduction by medusiform gonozooids, but without polypary—*Corymorphidæ* ; *Corymorpha*, with sessile gonophores ; *Halatractus*, with pedicellate gonophores.

The character of the tentacles in all the families agrees with Mr. Hincks' diagnosis of *Tubulariidæ*, and I have therefore retained the arrangement of that author.

GENUS I. TUBULARIA, *Linnæus* (in part).

*Stems* simple or branched, rooted by a filiform stolon, the whole invested by a polypary. *Polypites* flask-shaped. *Tentacles* as in family character. *Gonophores* borne on peduncles springing from the body of the polypite between the two circles of tentacles, and developing fixed sporosacs.—T. H.

1. T. INDIVISA, *Linn.*

*T. calamaris* (*Pal.*, *Ehr.*), ? *T. gigantea* (*Lamæ.*),  
*Tubulaire chalumeau* (*De B.*).

**Hab.:** Common. Height 6—12 in. Stems clustered, straight, smooth, brown-coloured. Polypites pale pink to crimson or scarlet. Proximal tentacles white, 20—30 in a single verticil. Distal tentacles white, short, and numbering about 40. Peduncles of gonophores scarlet.

This species is described by Ellis ("Corallines," 31) as the "tubular coralline, like oaten pipes." He describes it as "the largest of the tribe of British tubulous corallines. It arises from small worm-like figures, many of which grow together and look like the guts of small animals. From this state they rise into distinct tubes of 5 and 6 inches long. On the top of these the polyps appear with plumed crests. These tubes in the dried specimens have the resemblance of oaten pipes, that is, part of an oat straw with the joints cut off."

The difference between this species when living, each tube bearing its ruddy flower, and when dead and its tubes tenantless, is very great.

In some districts it is very luxuriant. Mr. Hincks states that he received a bucketful from the landing-stage at Liverpool, and Mr. C. L. Jackson informs me that they are found in profusion upon the supports of the Southport pier.

The tubes are often very numerous, as many as 150 being sometimes crowded together. Sir J. G. Dalzell observes, that "if the florist enjoys the bloom of those resplendent gems which, void of evident sensation and motion, yet stud the verdant fields or decorate his gardens, so much the higher should we prize these

living tenants of the deep, which testify the action and volition diffused throughout their beautiful and luxuriant flourish."

Dr. Landsborough refers to the fact that if these polyps be kept in captivity for a few days, the heads drop off, and remarks that "it would be all over with a man, even the wisest, if his head were to drop off, unless we were to give credit to the legend of one of old, who, when decapitated, could run with his head under his arm; but this marine knight of the oaten pipes can survive what would prove fatal to our doughtiest hero." Soon after the dropping off of a head, a new one appears, and this process of re-capitulation may be often repeated, a ring on the polypary being formed each time.

2. *T. LARYNX*, *E. and S.* (including *T. coronata*, Abildgaard). Plate III. fig. 7.

*T. muscoides* (*Pal., Turt., Bosc, Fl., De B.*), *Eudendrium Bryoides* (*Ehr.*), *Tubularia coronata* (*Abildgaard, V. B., All., T. H.*), *T. gracilis* (*Harvey, G. J., D. L., Ald., P. H. G., McA.*).

Hab.: Common. Height  $\frac{1}{2}$ — $1\frac{1}{2}$  in. Stems clustered, straw-coloured, ringed at intervals, whence its specific name. Polypites rose colour, with 14—20 distal tentacles, and about 20 proximal tentacles all white. Gonophores hanging in clusters from rose-coloured peduncles, which are often racemously branched, and "as long as the proximal tentacles."

Prof. Allman considers the species *T. larynx* and *T. coronata* as one species, the latter being, however, a larger variety, sometimes attaining the height of 3 inches.

Ellis ("Corallines," 30) describes this as the "tubu-

lous coralline wrinkled like the windpipe," and states that "it is found in great plenty near the opening of the Thames, adhering to other marine bodies, and often to the bottoms of ships." "I have," says he, "often received it with the animals alive in sea-water, in which state it affords a most agreeable scene; the top of each tube bearing a bright crimson-coloured polyp, equal in richness to the Guernsey Lily, all the animals displaying their claws or tentacula at the same time, with surprising agility." The stem is flexible, and would appear to be to some extent under the control of the polyp. Mr. Paterson, of Belfast, says, "that in a specimen obtained by him he observed it coiling itself up, uncoiling, stretching, twisting, knotting itself in a way that resembled the *Gordius aquaticus*." \*

Dr. Johnston, writing of the form *T. coronata*, considered the appearance of the polyps when all displayed as a very interesting and pretty spectacle, equalled by no other species he had seen; the crimson heads contrasting finely with the white polypidoms, especially when loaded with the gonophores, which pullulate from the inner side of the base of the inferior tentacula, each separate gonophore being of a roundish or oval shape, having a dark red cylindrical centre." ("British Zoophytes," 1st edit., 116.)

3. *T. SIMPLEX*, Alder.

*T. Dumortierii* (*G. J.*, *Ald.*, *D. L.*, *McA.*).

Hab.: Cullercoats (*Ald.*), Berwick Bay (*G. J.*), Oban (*T. H.*). Height 2—2½ in.

This is a deep-water species.

Dr. Johnston, who is followed by Dr. Landsborough,

\* Landsborough, "Zoophytes," 118.

describes this species under the name of *T. Dumortierii*. He says that "it is so like *T. indivisa* that one might conjecture that it was that species in miniature, but there can be no doubt of its distinctness, this species being much smaller, and also solitary in habit."

The stem is angulated at intervals.

5. *T. BELLIS*, *All.*

Hab.: Shetland. Height  $\frac{3}{4}$ —1 in. Stem regularly marked by annulations. "Coenosarc orange, deepening in tint towards the base, expanding into a collar immediately below the polypites. Polypite 5 lines across, scarlet. Proximal tentacles 20; distal 15—20, all white."

"An exquisite little hydroid."—*Allman*.

6. *T. BRITANNICA*, *Pennington*. Plate III. fig. 8.

Hab.: Menai Straits. Height about 1 in. Coenosarc orange, ringed at the base. Polypite large, crimson, borne on a collar-like extension of the coenosarc. Distal tentacles crimson, 15. Proximal tentacles white, long, about 30. Gonophores oval, on white-branched peduncles, 3—6 in a cluster.

I found this species in May last, whilst collecting in the Menai Straits. At first I thought it identical with the preceding, but it will be seen to have several distinguishing features. I found it near the base of the Britannia Tubular Bridge, hence the specific name.

7. *T. ATTENUATA*, *All.*

Hab.: Firth of Forth and Shetland. Height 3—4 in.

This is a deep-water species, somewhat resembling *T. simplex*, *Ald.*

8. *T. HUMILIS*, *All.*

Hab.: Kinsale Harbour. Height 1 in.



"A very elegant little hydroid, resembling *T. bellis* in its mode of growth, but distinguished by the absence of distinct annulation, and by the smaller size of the polypites."—*Allman*.

A very beautiful plate, illustrative of *T. bellis*, *T. attenuata*, and *T. humilis*, is given in Prof. Allman's "Gymnoblastic Hydroids," Plate XXII.

GENUS II. ECTOPLEURA, *Agassiz*. (ἐκτός, outside,  
πλευρός, a rib.)

*Stems* fistular, simple, or branched, rooted by a filiform stolon, all enclosed in a polypary. *Polypites* flask-shaped, with tentacles as in last genus. *Gonophores* originating free medusæ.—*T. H.*

1. *E. DUMORTIERII*, *Van Beneden*.

*Tubularia Dumortierii* (*V. B.*, *G. J.*, *D. L.*, *P. H. G.*).

Hab.: Point of Ayr, Isle of Man (*T. H.*). Height about  $\frac{1}{2}$  in.

The only specimen found in Britain is that found by the Rev. Mr. Hincks as above. The species was described by Van Beneden ("Mém. sur les Tubul.," 50) from specimens obtained at Ostend, parasitic on *Flustra*, &c.

Prof. Allman refers this species and genus to a family *Hybdocoridae*, as stated above in the remarks upon the family characters of *Tubulariidae*.

GENUS III. CORYMORPHA, *Sars*. (κορύνη, a club,  
μορφή, form.)

*Polypite* solitary, borne on a simple stem, which terminates in a conical base, and is invested by a delicate membranous sheath. Distal *tentacles* in several verticils close together. Proximal *tentacles* in

a single series. *Gonozooids* sessile,\* or on branched peduncles borne at the base of the lower tentacles, free and medusiform.—T. H.

This genus is one of the three genera of *Hydroida* which have solitary polypites, the other two being *Hydra* and *Myriothela*.

1. *C. NUTANS*, Sars. Plate IV. fig. 1.

Hab.: Orkneys (*Forbes* and *Goodsir*), Shetland (*Forbes*), Fowey (*C. W. P.* and *Ald.*), Isle of Man (*Ald.*), Seaham Harbour, Durham (*Hodge*), Firth of Forth (*All.*). Height 2—4½ in. Polypite large, light red. Distal tentacles about 80, arranged in several rows. Proximal tentacles about 30, white and long. Polypary replaced by a delicate pellicle. Gonozooids "naked, borne in clusters at the extremities of branched stalks."

The marginal bulbs of the gonozooid are without tentacles, except one which bears a single very long tentacle, clustered with thread cells.

"When placed in a vessel of sea-water it presented the appearance of a beautiful flower. Its head gracefully nodded (whence the appropriate specific appellation given to it by Sars), bending the upper part of its stem. It waved its long tentacula to and fro at pleasure, but seemed to have no power of contracting them. It could not by any means be called an apathetic animal, and its beauty excited the admiration of all who saw it."—*Forbes and Goodsir*.

The stem, as in *Tubularia*, contains a number of canals for the distribution of the nutrient fluid. These canals give a lined appearance to the stem of this species.

\* By stating this double mode of growth, the necessity of making a new genus for *C. nana* is obviated.

The *Corymorpha* is enabled to attach itself by a modified hydrorhiza not only to stones and other firm bases, but to sand. In the latter case the hydrorhiza takes the form of hair-like rootlets.

The species was first described by Forbes and Goodsir in the Annals of Nat. Hist. for 1840. It has been thoroughly investigated by Prof. Allman, "Gymnoblastic Hydroids," 205.

2. *C. NANA*, Ald.

Hydractinia (*G.J.*, B.Z., 463), Halatractus nana (*All.*).

Hab.: North-East Coast. Height  $\frac{1}{2}$ — $\frac{3}{4}$  in.

Described by Alder in "Northumberland and Durham Cat. Trans. F. C.," iii. 108, and in the supplement to the same Transactions, v. 233. This species is smaller than *C. nutans*, and has sessile gonophores.

## FAMILY XII. CLADOCORYNIDÆ.

*Polypites* with both simple and branched capitate tentacles

### GENUS CLADOCORYNE, Rotch.

*Stem* invested by a chitinous polypary, and rooted by a creeping filiform stolon. *Polypites* claviform, with a single wreath of simple capitate tentacles round the mouth, and several verticils of capitate tentacles on the rest of the body.—ROTCH.

1. *C. FLOCCOSA*, Rotch.

Hab.: Herm (*Rotch.*). Height  $\frac{1}{2}$  in.

Described in A. and M. of Nat. Hist., March, 1871.

The species is remarkable from the possession of branched tentacles which form three or four verticils round the body, with three or four tentacles in each verticil. The colour is reddish-brown, with an opaque

white distal extremity. Reproduction is by fixed sporosacs. Prof. G. du Plessis has investigated the structure and development of the polypite.\*

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## SUB-ORDER II. THECAPHORA.

### FAMILY I. CAMPANULARIIDÆ.

*Hydrothecæ pedicellate, campanulate. Polypites with a large trumpet-shaped proboscis.*—T. H.

This family includes some of the most beautiful forms of *Hydroida*. The calyces often transparent, with their flower-like contents, form exceedingly pretty objects, and the gracefully branched appearance of some species makes them conspicuous amongst zoophytes for delicacy and loveliness. The classification of the members of this family presents great difficulty, as it depends mainly upon the reproductive system.

#### GENUS I. CLYTIA, *Lamouroux* (in part).

*Stem* simple or slightly branched, rooted by a creeping stolon. *Hydrothecæ* bell-shaped, without operculum. *Polypites* with a large trumpet-shaped proboscis. *Gonothecæ* borne on the stolon and on the stems, producing free medusiform zooids. *Gonozooid* (at the time of liberation) almost bell-shaped, marginal tentacles 4. *Lithocysts* 8, placed on the free margin of the umbrella.—T. H.

1. C. JOHNSTONI, *Alder*. Plate IV. fig. 2.

\* M. T., Zool. Sta. Neapel., ii (1880), pp. 176—196.

*Sertularia volubilis* (E. and S., Berk., Turt., Stew. Bosi, Hogg), *Campanularia volubilis* (G. J., Couch, Hincks, A. N. H., July, 1852, D. L., Gosse), *C. Johnstoni* (Ald., T. S. W., All., McA.), *Eucope campanulata*, *thaumantoides*, and *affinis* (Gegenbaur), *Campanularia bicophora* (Ag.).

Hab.: Extremely common between tide-marks to deep water. Height  $\frac{1}{4}$  in. Stems simple, transparent, ringed at the base and below the calyche. Calyche campanulate, with about 11 indentations on the rim. Gonothecæ oval, deeply ringed. Polypite large, with about 25 long tentacles.

Mr. Hincks has divided the *Campanularia volubilis* of Johnston into two species, viz. *Clytia Johnstoni* and *Campanularia volubilis*. Dr. Johnston evidently, from his list of synonyms, included both forms under the latter designation.

*C. Johnstoni* is a common but very elegant species. "The cells," says Gosse, "are shaped like an old-fashioned ale-glass, being long and narrow, with a slight constriction just above the point of connection with the footstalk, where a false bottom or diaphragm runs across, perforated with a narrow hole in the centre," through which the cœnosarc is prolonged. The polypite is large and dilated at the base into a sort of foot, which spreads over the diaphragm. It has a large, fleshy, trumpet-shaped proboscis, the lips of which possess remarkable powers of contraction and changes of form. The gonothecæ develop free medusæ. These medusæ are from  $\frac{1}{40}$ — $\frac{1}{30}$  in. in size at the time of liberation, and have attracted much notice from their great beauty of form. They were first observed by Van Beneden, and are also described fully by Mr.

Gosse,\* who humorously alludes to the alternation of generations caused by the production of these medusiform zooids, and states that any individual is not like its mother or its daughter, but exactly like its grandmother and granddaughter.

GENUS II. OBELLIA, Péron and Leseur.

*Stems* branching, plant-like, rooted by a creeping stolon. *Hydrothecæ* campanulate, without operculum. *Gonothecæ* borne on the stem and branches. *Reproduction* by free medusiform zooids. *Gonozooid* (at time of liberation) depressed and disc-like; marginal *tentacles* numerous. *Lithocysts* borne on the inner side of 8 tentacles near the base.—T. H.

1. O. GENICULATA, Linnæus. Plate IV. fig. 3.

*Sertularia geniculata* (Linn., Pal., Lk., Müll., E. and S., Berk., Turt., Stew., Bosc., Hogg), *Laomedea geniculata* (Lamx., Temp., De B., P. H. G., G. J., R. Q. C., D. L., McA.), *Campanularia geniculata* (Flem.), *Monopyxis geniculata* (Ehr.), *Eucope diaphana* (Ag.), *E. alternata* (Ag.).

Hab.: Generally distributed on seaweeds near low-water marks. Height 1 in.

"Stem zigzag, white, jointed at each bend and thickened immediately below, so as to form a series of projections or elbows." Calyces bell-shaped, with entire rims borne on short ringed pedicels. *Gonothecæ* urn-shaped, borne in the axils between the pedicels and the stem. Polypites with about 12 tentacles and a large proboscis.

This is the "knotted thread coralline" of Ellis, who likens the *gonothecæ* to oil jars with necks to them.

\* "Devonshire Coast," 299.



Dr. Johnston more elegantly likens them to Greek vases or urns. Mr. Gosse describes it in his "Devonshire Coast" as the "angled Laomedea," in allusion to the zigzag form of the stem, which "shoots up from a creeping root that meanders over the seaweed, every angle of the stem bearing a glassy cell inhabited by a many-tentacled polyp."

The gonozoids, like those of *O. Johnstoni*, have attracted great attention from their singular beauty. Mr. Gosse\* says, "So exquisitely delicate is the tiny creature, so transparent, so shadowy, that a friend to whom I showed it aptly called it the *soul* of the zoophyte."

The *O. geniculata* generally grows in forest-like masses. The species is phosphorescent, and shows this quality strongly if agitated in the dark, the spectacle "bearing a resemblance sufficiently striking to the illumination of a city, or rather to the gas jets of some figure of a crown or V. R. adorning the house of a loyal citizen on a gala night; the more because of the momentary extinction and relighting of the flames here and there, and the manner in which the successive ignition appears to run rapidly from part to part."

2. *O. GELATINOSA*, *Pal.* Plate IV. fig. 4.

*Cymodocea simplex* (*Lamx., R. Q. C., G. J.*), *Sertularia gelatinosa* (*Pal., Flem., Stew., Bosc*), *Laomedea gelatinosa* (*Lamx., De B., G. J., T. H., D. L., P. H. G., McA.*), *Campanularia gelatinosa* (*L. K.*).

*Hab.*: Exmouth (*Hincks*); Cornwall (*O. W. P.*). "In such abundance in the Solway that it is a nuisance" (*Sir W. Jardine*); Ayrshire (*D. L.*); St. Andrew's (*McL.*); Liverpool (*Collingwood*), Menai Straits (*A. S. P.*), &c. Height 8—10 in. Stem compound,

\* "Devonshire Coast," 84.

profusely branched, dark brown, branches white. Calyces bell-shaped, very transparent and hyaline, with castellated rims.

This species is referred to by Mr. Gosse as the "slimy *Laomedea*."

The peculiar calyces are a characteristic of this zoophyte, the margins being *castellated* with the separate turrets somewhat hollowed. The calyces are supported on short ringed tubes. The polypite is able to contract almost entirely within the calyce, drawing in its tentacles in a parallel bundle.

3. *O. LONGISSIMA*, *Pallas*.

*Sertularia longissima* (*Pal.*), *Monopyxis longissima* (*Ehr.*), *Laomedea dichotoma*, var.  $\beta$  (*G. J.*), *Laomedea longissima* (*Ald.*, *McA.*, *T. H.*), *Campanularia gelatinosa* (*V. B.*).

Hab.: Northumberland (*Ald.*); Peterhead and Cornwall (*C. W. P.*); Filey, Devon (*T. H.*); Blackpool (*A. S. P.*); St. Andrew's (*McI.*). Height 12 in. Stem long, dark coloured, branches fern-like, lighter coloured. Calyces cup-shaped, with "blunt and shallow teeth" borne on ringed pedicels. The branchlets taper towards the extremity of the stem, in which habit they are imitated by the pinnæ on the branchlets themselves. This tapering form adds largely to the graceful and fern-like appearance of the species.

This species has often been confounded with the succeeding one.

4. *O. DICHOTOMA*, *Linn.*

*Campanularia dichotoma* (*Lk.*, *Flem.*, *Stark*, *Grant*, *Temp.*, *Lister*), *Sertularia volubilis* (*Fabr.*), *S. dichotoma* (*Linn.*, *E. and S.*), *Laomedea dichotoma* (*Lamx.*, *De B.*, *G. J.*, *R. Q. C.*, *D. L.*, *P. H. G.*, *McA.*),



Hab.: Common. Height 2 inches. Stem slender, branched, horn colour. Calyces bell-shaped, placed alternately on the branches and borne on short ringed pedicels, the branches themselves being ringed above the point where the pedicels are attached. The rim, though at first sight entire and plain, is seen to be really somewhat wrinkled.

This species is the "Sea-thread Coralline" of Ellis, who says, "that it seems curiously contrived from its structure to resist the violence of the waves, all its joints being furnished with springs."

5. *O. FLABELLATA*, *Hincks*.

? *Sertularia dichotoma* (*Dal.*), *Campanularia flabellata* (*T. H.*).

Hab.: Tenby (*Ald.*). Height 8—10 in.

This species, often confounded with the preceding, differs from it in being larger, more flexuous, and in having its calyces triangular in shape.

Described by Mr. Hincks in *Annals of Nat. Hist.* (3rd ser.), xviii. 297, under the name *Campanularia flabellata*.

6. *O. (?) PLICATA*, *Hincks*.

Hab.: Shetland (*Jeffreys*). Height 3—4 in.

This species has a thick compound stem. The calyx is very like that of *O. dichotoma*.

It is provisionally referred to this genus by Mr. Hincks, who figures it at Plate XXX. of his "British Hydroid Zoophytes."

### GENUS III. *CAMPANULARIA*, *Lamarch* (in part).

*Stem* as in last genus. *Hydrothecæ* bell-shaped and hyaline without operculum. *Polypites* with a large cup-shaped proboscis. *Gonophores* containing fixed

sporosacs, which mature their contents within the capsule.—T. H.

1. *C. VOLUBILIS*, *Linn.*

*C. grimpante* (*De B.*), *Sertularia volubilis* (*Linn.*),  
*S. uniflora* (*Pal.*).

Hab.: Widely distributed. Parasitic on zoophytes.

Resembles *C. Johnstoni*, but is smaller, and has its stem spirally twisted with a single ring below the calycle.

Ellis ("Corallines," 24) describes this species as the "small climbing coralline with bell-shaped cups." "It rises from small irregular tubes, which adhere to and twine about other Corallines, especially *H. falcata*. Exceedingly small twisted stalks go out from the twisted stem, which support little bell-shaped cups with indented brims. At the bottom of each, where it joins the stalk, the microscope discovers to us a very minute spherule or little ball, as in some drinking-glasses." Sometimes the stem, instead of being twisted, is found plain. Mr. Hassall thinks that the ring beneath the calycle serves the purpose of a hinge or joint to enable the zoophyte better to elude the rude contact with the element by which it is surrounded, permitting it to bend to a force which it cannot resist.

2. *C. HINCKSI*, *Ald.*

Hab.: Rather rare. Torbay, Oban (*Hincks*), Northumberland and Durham (*Ald.*), Hebrides (*A. M. N.*), North of Ireland (*Thompson*), St. Andrew's (*McL.*).

This species was considered by Mr. Hincks at first as a variety of *C. volubilis*, from which, however, it is distinguished by having the stem generally smooth, except that there are one or two twists at the base, and by having two or three rings just below the calycle,

which is lineated, and has a castellated rim with fourteen denticles. The gonothecæ are generally ovule and ringed, those of *C. volubilis* being flask-shaped and smooth.

3. *C. INTEGRA*, *Macgillivray*.

? *C. lævis* (*R. Q. C.*, *P. H. G.*).

Hab.: Donmouth (*Macgillivray*), Hastings (*Saunders*), Ilfracombe, Filey (*Hincks*), Bamborough (*Ald.*), Wick (*C. W. P.*), Isle of Man (*D. L.*).

This is a very pretty species. The stem is simple, slender, and twisted, with two or three rings below the calyces, which are bell-shaped and have a plain rim. The gonothecæ are very curious, being spirally twisted.

4. *C. CALICULATA*, *Hincks*.

*C. breviscyphia* (*Sars*), *Clytia poterium* (*Ag.*).

Hab.: Ramsgate (*Boswell*), Ilfracombe, Swanage (*Hincks*), Jersey (*A. M. N.*), &c. Height  $\frac{1}{2}$  in. It is found generally on red algæ, and is very beautiful.

The peculiarity of this species is that the calycle appears double, from the fact that the cavity is enclosed by a greatly thickened though transparent wall, "giving the calycle the appearance of an inverted bell-handle."

The stem is simple and crenated, with a single distinct ring below the calycle.

5. *C. VERTICILLATA*, *Linn.*

*Sertularia verticillata* (*Linn.*, *Pal.*, *E. and S.*, *Turt.*, *Bosc.*, *Hogg*), *Clytia verticillata* (*Lamx.*), *Halecium verticillatum* (*Oken*), *Capsularia verticillata* (*Gray*), *Lao-medea verticillata* (*De B.*).

Hab.: Common, especially on the south-west coast. Height about 3 in. Stems branched. Upon both stem and branches are pedicels given off in distinct

and equidistant whorls ; about 5 pedicels in each whorl. Calyces bell-shaped, with 12 pointed teeth.

This is the " Horse-tail Coralline " of Ellis, and this name, showing its similarity to the *Equisetum*, gives a good idea of the appearance of the zoophyte.

6. *C. FLEXUOSA*, *Hincks*. Plate IV. fig. 5.

*Laomedea gelatinosa* (var. *a. G. J., R. Q. C.*), *L. flexuosa* (*T. H., All., McA.*).

Hab.: Common. Height 1 in. Stem horn colour, somewhat bent and giving off pedicels at the joints, ringed at the base and above the joints of the pedicels. Calyces alternate with a plain rim, borne on ringed pedicels. Tentacles webbed towards the base. Female gonothecæ large, oval, with a straight top.

This is a very common species, found in the littoral zone on almost every part of the coast, and spreading in dense forest-like masses upon weeds and stones.

7. *C. ANGULATA*, *Hincks*. Plate IV. fig. 6.

*Laomedea angulata* (*McA.*).

Hab.: On *Zostera marina*. Ramsay, Torbay (*Hincks*), Jersey (*A.M.N.*), Menai Straits (*A.S.P.*). Height  $\frac{1}{2}$ — $\frac{3}{4}$  in. Stem bent so as to form distinct obtuse angles, with long internodes. Ringed pedicels given off at the angles. Polypite with about 24 tentacles.

A peculiarity of this species is that the extremity of the stem is prolonged into a long tendril-like clasper, thickened towards the end and annulated at the base. Mr. Hincks states that he has seen specimens in which the stem was only  $\frac{1}{2}$  in. in length, with a tendril  $\frac{1}{2}$  in. long ; and I have myself observed a similar disproportion.

8. *C. NEGLECTA*, *Ald.*

*Laomedea neglecta* (*Ald.*).

Hab.: Common. Height  $\frac{1}{2}$ — $\frac{3}{4}$  in. occasionally. Stem delicate, generally minute and filiform, ringed above the origin of the pedicels. Calyces alternate, bell-shaped, with about 8 minute turreted crenulations borne on ringed pedicels.

9. *C. EXIGUA*, Sars.

*Laomedea exigua* (Sars).

Hab.: Swanage (Hincks). Height  $\frac{1}{4}$  in. Stem delicate, angular, giving off pedicels, ringed at the base and below each calycle. Calyces funnel-shaped, with plain rims.

10. *C. DECIPIENS*, T. S. W.

Hab.: Firth of Forth (T. S. W.).

Much resembles *C. neglecta*, but has margin of calycle plain. Described by Dr. Wright in the Journal of Micr. Science (N.S.), iii. 49.

11. *C. (?) GIGANTEA*, Hincks.

Hab.: Lamlash Bay, Arran (Prof. Wyville Thomson). Height about an inch.

This species, described by Mr. Hincks in the Annals of Nat. Hist. for October, 1866, from a single specimen, is remarkable for the size of the calyces, which "are always gigantic for the tribe."

12. *C. (?) FRAGILIS*, Hincks.

Hab.: Ilfracombe (Hincks). Height about  $\frac{1}{8}$  in.

Described by Mr. Hincks in the Annals of Nat. Hist. for January, 1863.

This species somewhat resembles *C. neglecta*, but is more delicate and graceful. The calyces are very long and narrow.

13. *C. RARIDENTATA*, Ald.

Hab.: Cullercoats (Alder), Torquay, Brixham, Swanage Bay (Hincks), St. Andrew's (McI.). Height  $\frac{1}{12}$  in.

"A minute species, with a slender calycle, and a very small number (5 or 6) of marginal denticles."

Described by Mr. Alder in the Suppl. North. and Durh. Cat., in Trans. Tynes. F. C., v. 238.

Species 11, 12, and 13 are only provisionally referred to this genus by Mr. Hincks.

#### GENUS IV. LOVÉNELLA, *Hincks*.

*Stems* simple or slightly branched, rooted by a thread-like stolon. *Calycles* turbinate, elongate, crowned with a distinct conical operculum composed of many convergent segments. *Polypites* with a large and prominent proboscis.—T. H.

##### 1. L. CLAUSA, *Lovén*.

*Campanularia clausa* (*Lovén*).

Hab.: Torbay (*Hincks*).

This is named after Lovén the Swedish naturalist, who was the first to describe it.

It is recognizable by its graceful turret-like, hyaline calycles, surmounted by conical opercula, composed of about 8 convergent segments, which fit into as many rims in the margins of the calycles. The polypite has a large prominent proboscis and about 15 tentacles.

#### GENUS V. THAUMANTIAS, *Eschschlotz*.

*Stem* simple (or branched?), rooted by a thread-like stolon. *Hydrothecæ* campanulate. *Polypites* with a prominent funnel-shaped proboscis. *Reproduction* by free medusiform zooids. *Gonozoid*, umbrella hemispherical.—T. H.

##### 1. T. INCONSPICUA, *Forbes*.

Hab.: Hebrides (*Forbes*), Firth of Forth (*T. S. W.*).

This species was originally only known in its medu-

soid phase, but Dr. Wright reared the polypites from the ova, and by that means was enabled to identify and describe the species. The stem of the trophosome is simple, sometimes ringed throughout. The calycle has 8 or 9 denticles. Described in Forbes' "Monograph of British Naked-eyed Medusæ," 52, and by Dr. Wright in the Journal of Micr. Science (N.S.), ii. 221 and 308.

GENUS VI. GONOTHYRÆA, *All.* (γόνος, offspring, θυραῖος, outside the door.)

*Stem* erect and branched, rooted by a thread-like stolon. *Calycles* campanulate and hyaline. *Polypites* with a prominent contractile proboscis. *Reproduction* by fixed medusiform sporosacs, furnished with a circle of filiform tentacles.—T. H.

1. G. LOVÉNI, *All.*

*Campanularia dichotoma* (*Lister*, V. B.), *C. geniculata* (*Lovén*, V. B., *Schultze*), *Laomedea dichotoma* (*T. S. W.*), *L. Lovéni* (*All.*, *McA.*).

*Hab.*: Brighton (*Lister*), Dartmouth, Torquay, Oban (*Hincks*), Cullercoats (*Ald.*), Firth of Forth (*All.*), Shetland (*Nor.*), Carrickfergus, Monkstown (*Prof. W. Thomson*), Menai Straits (*A. S. P.*). Height  $\frac{1}{2}$  in.

Ellis accurately figures this species ("Corallines," pl. xii. C, and xxxviii. B), but identifies it with his "Sea-thread Coralline," the remaining figures of which (pl. xii., figs. a, A) refer to *O. dichotoma*.

This species grows in bushy tufts, and somewhat resembles *C. flexuosa* in appearance. The calycles are alternate with indented margins (10 teeth), and borne on ringed pedicels.

"There is nothing to distinguish this genus from

*Campanularia* or *Obelia*, but the structure and history of the sexual zooids, which are medusiform but never become free, and therefore combine to some extent the characters of the free and fixed forms."—*Hincks*.

2. *G. GRACILIS*, *Sars*.

*Laomedea gracilis* (*Sars*).

Hab.: Connemara (*Brady*). Height about  $\frac{3}{4}$  in. Stem filiform, giving off slender branchlets, each terminating in a single calycle. Calyces deep and narrow, with pointed denticles. Pedicels ringed below the calyces and above their junction with the stem.

3. *G. (?) HYALINA*, *Hincks*.

Hab.: Shetland (*Jeffreys*). Height about 2 in.

This is probably a deep-water species, and was described by Mr. Hincks in the *Annals of Nat. Hist.* xviii. (3rd series), 297. It appears to be a graceful and beautiful species.

GENUS VII. SCHIZOCLADIUM.\* ( $\sigma\chi\iota\zeta\omega$ , to divide,  $\kappa\lambda\alpha\delta\acute{\iota}\omega$ , a branchlet.)

*Stem* rooted, branching, carrying besides the ramuli bearing polypites, other branchlets (fissiparous appendages) which spring from various parts of the stem and are cylindrical, simple, and never support either polypites or generative buds. *Calyces* inoperculate. *Gonosome* unknown.—Allman.

This genus was established by Prof. Allman (*Q. J. M. S.*, xi. 18) for a species discovered by him in Loch Long. The peculiarity of that species is that, in addition to the ordinary modes of reproduction, nume-

\* The Rev. Thos. Hincks, A. and M. of Nat. Hist. (4), x. 385, rejects this genus on the ground that he has observed the same mode of reproduction in *C. neglecta*. He considers Prof. Allman's species to be probably an *Obelia*.



rous club-shaped branchlets or ramuli, which Prof. Allman calls *fissiparous appendages*, are produced from various parts of the stem. The contained *cœnosarc* in these ramuli bursts through the *perisarc* at the end of the ramulus and continues to grow. After a while a constriction appears in the *cœnosarc* a little below the end of the branchlet, which constriction advances until a piece of the *cœnosarc* is cut off and passes into the water as a free zooid, about  $\frac{1}{300}$  in. in length, and resembling a *planula* without cilia. This *frustrule* ultimately attaches itself, and serves as a stolon or hydro-rhiza to a new colony which springs from a bud in its side. Prof. Allman refers to the fact that in the case of *C. nutans* similar bodies appear to be discharged, which, however, directly develope into hydranths.

1. *S. RAMOSUM*, All.

Hab.: Loch Long (All.). Height about 1 in. Stems much branched. Branches ringed at origin and for some distance from distal extremities. Fissiparous appendages annulated, equal to or longer than branches, and regularly distributed over the stem. Polypite with 24 tentacles, which when fully extended are alternately elevated and depressed. Calyces with even margins.

FAMILY II. CAMPANULINIDÆ.

*Calyces ovato-conic, pedicellate. Polypites cylindrical, with a small conical proboscis.*—T. H.

GENUS I. CAMPANULINA, Van Beneden.

*Stem* simple or branched, rooted by a thread-like stolon. *Calyces* produced and pointed above. *Polypites* with webbed tentacles. *Reproduction* by free medusiform gonozooids.—T. H.

1. *C. ACUMINATA*, Ald.

*C. tenuis* (V.B.), *Laomedea acuminata* (Ald., T. S. W., McA.), *Wrightia acuminata* (Ag.).

Hab.: Cullercoats (Ald.), Firth of Forth (T. S. W.). Height about  $\frac{3}{4}$  in. Stem ringed almost throughout. Calyces membranous, with linear striations tapering to a point, presenting, when closed, the appearance of a closed Chinese umbrella. Polypites with about 20 very long, webbed tentacles. Gonothecæ large, pedicellate, cylindrical. The tentacles are webbed in a very distinct manner to about one-sixth of their length, the webs being "studded with thread cells." "The cells," says Alder, "are extremely elastic and membranous, changing form with the polyp, and scarcely to be distinguished from it when alive, excepting at the apex when the animal is withdrawn."

2. *C. REPENS*, All.

Hab.: Firth of Forth (All.).

In this species the calycle is "crowned by long converging segments which, on the retreat of the polyp, form a true operculum." The tentacular web is not so fully developed as in the preceding species.

Described by Professor Allman in "Notes on the Hydroida," in the Ann. of Nat. Hist., July, 1864.

3. *C. TURRITA*, Hincks.

Hab.: Belfast Lough (Prof. W. Thomson).

Described by Mr. Hincks (B. H. Z., 190, pl. xxxvi. 2) from drawings supplied by Prof. Thomson. The species appears to unite the characteristics of *C. acuminata* and *C. repens*.

GENUS II. *ZYGODACTYLA*, Brandt.

*Stem* simple or branching, rooted by a filiform stolon.

*Calycles* with an operculum formed of many converging and acuminate segments. *Polypites* cylindrical, with the tentacles webbed below. *Reproduction* by free medusiform gonozooids.—T. H.

The difference between this genus and the preceding is that the adult gonozooids of the present genus have many radiating canals, whereas those of *Campanulina* never have more than four.

1. *Z. VITRINA*, Gosse.

*Æquora vitrina* (P. H. G., T. S. W.).

Hab.: Ilfracombe (Gosse), Scotland (Wright).

*Polypites* very minute. The sexual zooid is described by Mr. Gosse ("Devonshire Coast," 340) under the name *Æquora vitrina*, or the glassy *Æquora*. He describes it "as an exquisitely beautiful translucent species, without a trace of colour in the whole animal, and luminous when irritated in the dark." Dr. Wright hatched the ova of this medusa, and traced the development into minute *polypites*, invisible to the naked eye. The tentacles are united by a web for about one-third of their length.

GENUS III. OPERCULARELLA, Hincks.

*Stem* simple or branching, rooted by a thread-like stolon. *Calycles* ovato-conic with a cleft border, the segments converging to form an operculum. *Polypites* long, cylindrical, and with a conical proboscis. *Reproduction* by means of fixed sporosacs.—T. H.

"This genus is constituted from the *Campanularia lacerata* of Johnston."

1. *O. LACERATA*, G. J.

*Campanularia lacerata* (G. J., V. B., D. L., P. H. G.),

*Capsularia lacerata* (Gray), *Laomedea lacerata* (T. H., T. S. W., Ald., P. H. G., McA.), *Wrightia lacerata* (Ag.), *Calycella lacerata* (All.).

Hab.: St. Ives, Exmouth, Ilfracombe, Isle of Man, Filey, Oban (*Hincks*), Berwick (*G. J.*), Northumberland (*Ald.*), Firth of Forth (T. S. W.), St. Andrew's (*Reid*), North of Ireland (*Thomson*). Height from  $\frac{1}{2}$ — $1\frac{1}{4}$  in.

In this species the upper part of the calycle is divided into six deep lanceolate segments, which collapse and form an acute apex or roof. The tentacula are very extensile. Prof. Reid states that they can be extended twice the length of the cell. The stem is annulated throughout.

### FAMILY III. LEPTOSCYPHIDÆ.

*Calycles* ovato-conic. *Polypites* cylindrical, with a conical proboscis. Generative elements produced in the walls of the manubrium. *Lithocysts* wanting.—T. H.

GENUS LEPTOSCYPHUS, Allman. (λεπτός, delicate, σκύφος, a cup.)

Stem simple or branching, attached by a thread-like stolon. *Calycles* with an operculum composed of divergent segments. *Polypites* cylindrical, with a conical proboscis. Reproduction by free medusiform zooids.—T. H.

L. TENUIS, All.

*Laomedea tenuis* (All., McA.).

The medusiform zooid of the species is identical with the *Lizzia* of Forbes. This is the only species of the *Thecaphora* in which the generative elements are produced in the walls of the manubrium of the gonozooid.

This zoophyte has been found by Prof. Allman at Stromness, and described by him in the Ann. of N. H., November, 1859, and May, 1864.

#### FAMILY IV. LAFOËIDÆ.

*Calycles tubular.* Polyps cylindrical, with a conical proboscis.—T. H.

##### GENUS I. LAFOËA, Lamouroux.

*Stem* a simple creeping tubular fibre, or erect and composed of many tubes aggregated together, rooted by a filiform stolon. *Calycles* tubular, sessile, or with a short pedicel, without an operculum, more or less regularly disposed on the stem and branches.—T. H.\*

1. *L. dumosa*, Fleming. Plate IV. fig. 7.

*Sertularia volubilis* β. (*Pal.*), *S. dumosa* (*Flem.*), *Tubularia tubifera* (*G. J.*), ? *L. cornuta* (*Lamx.*), *Campanularia dumosa* (*Flem.*, *G. J.*, *D. L.*, *R. Q. C.*, *P. H. G.*, *Ald.*), *Cornularia dumosa* (*R. Q. C.*), *C. rugosa* (*Gray*), *Capsularia dumosa* (*Gray*), *Calicella dumosa* (*T. H.*, *McA.*), *Laomédée touffue* (*De B.*).

*Hab.*: Very common and generally distributed. Height very minute, and from 2—4 in.

There are at least two distinct varieties of this species. The larger is irregularly branched and formed of parallel tubes. The smaller variety is very profuse in its growth, and covers other zoophytes or stones, forming "a kind of brown beard" upon them. The

\* Prof. Allman ("Report on Gulf-Stream Hydroids," 11 n) says that he regards, as an essential character of the genus, the absence of any definite floor to the hydrotheca, the cavity of which passes direct into the stem or supporting pedicel.

former variety is named *robusta*. The calyces are long, narrowed below, and sessile, and are produced from all sides of the stem.

2. *L. FRUTICOSA*, *Sars*.

*Campanularia fruticosa* (*Sars*), *C. gracillima* (*Ald.*, *McA.*), *Calicella fruticosa* (*T. H.*).

Hab.: Northumberland, Durham, and South Devon (*Ald.*), Oban (*Hincks*), Shetland (*Nor.*). Height 1—3 in.

This is a more slender species than the preceding, and of more delicate habit, the calyces especially being thin and fragile, and borne on distinct pedicels, which are "loosely twisted." The colour is light yellow.

3. *L. PARVULA*, *Hincks*.

*Calicella parvula* (*McA.*), ? *Campanularia parvula* (*P. H. G.*).

Hab.: North of Ireland (*Hincks*).

Described by Mr. Hincks in the *Ann. of Nat. Hist.* for March, 1853. The calyces are "exceedingly minute, of equal width throughout, until within a short distance of the base, where they are rounded off." They are borne on short ringed stalks.

4. *L. POCILLUM*, *Hincks*.

Hab.: Oban Bay (*Hincks*).

The calycle of this species, which is very minute, resembles a "very elegant little goblet mounted on a twisted stem; the lower half is the broadest portion, above it the sides are incurved, but they expand again towards the aperture."

5. *L. PYGMÆA*, *Alder MS.*

This form was discovered and described in manuscript only by Mr. Alder, and is described and figured by Mr. Hincks (*B. H. Z.*, pl. xl. fig. 3). Its position is rather doubtful.



GENUS II. CALYCELLA, *Hincks* (in part). (κάλυξ,  
a cup.)

*Stem* a creeping, tubular fibre, or erect, compound, and branched, rooted by a filiform stolon. *Calycles* tubular, with an operculum formed of convergent segments or a plaited membrane. *Polypites* cylindrical, with a conical proboscis. *Reproduction* by fixed sporosacs.—T. H.

1. C. SYRINGA, *Linn.* Plate V. fig. 1.

*Sertularia syringa* (*Linn.*, *Berk*, *Turton*, *Stew.*, *Bosc*), *S. volubilis* (*Pal.*), *S. repens* (*E. and S.*, *Hogg*), *Clytia syringa* (*Lamæ.*), *Campanularia syringa* (*Lk.*, *V. B.*, *Ald.*, *Flem.*, *G. J.*, *R. Q. C.*, *De B.*, *D. L.*, *P. H. G.*), *Capsularia syringa* (*Gray*), *Wrightia syringa* (*Ag.*).

*Hab.*: Very common. Height  $\frac{1}{8}$  in.

This species is described by Ellis ("Corallines," 25), under the name of the "Creeping Bell Coralline." It is very minute, and is parasitic on *M. pilosa* and other zoophytes. It is of a dark horn-colour, and has the calycle prolonged into an operculum. The calycles are borne on pedicels, which are twisted with from 4 to 9 rings. The margin of the calycle is seen to be slightly sinuated under the microscope.

2. C. FASTIGIATA, *Ald.*

*Campanularia fastigiata* (*Ald.*).

*Hab.*: Shetland, the Hebrides (*A. M. N.*), Cornwall (*Hincks*). Height of calycle  $\frac{1}{10}$  in. The calycle is long and tubular, borne on a ringed pedicel, and terminates above in two opposite points, "between which a membrane on each side slopes over the aperture, forming an operculum, resembling the roof of a house."

Described by Mr. Alder in the Ann. of N. H. for February, 1860.

GENUS III. CUSPIDELLA, *Hincks*. (*Ouspis*, a point.)

*Stem* creeping, filiform. *Calycles* cylindrical or sub-cylindrical, perfectly sessile, with a conical operculum composed of many pieces. *Polypites* as in last genus.  
—T. H.

1. *C. HUMILIS*, *Hincks*.

*Campanularia humilis* (*T. H.*, *Ald.*), *Calycella humilis* (*All.*, *McA.*).

*Hab.*: On the stems of zoophytes. Llandudno, Whitby, Shetland (*T. H.*), Anglesea (*A. S. P.*), North-umberland (*Ald.*). Very minute.

The sessile calycles are like "little cylinders rising directly from the creeping stem."

In the *Mag. and Ann. of Nat. Hist.*, 4th ser., xiii. 129, Mr. Hincks points out that he has added to our fauna the *Lafoëina tenuis* of Sars, which he describes as being "distinguished from *C. humilis* by possessing extraordinary appendages, allied in structure and functions to the sarcothecæ of the *Plumulariidae*, distributed in great numbers along the creeping stolon and among the calycles. They consist of filiform offshoots from the ectoderm, somewhat enlarged at the upper extremity, and invested by a thin, chitinous covering." This species Mr. Hincks discovered whilst dredging at Shetland.

2. *C. GRANDIS*, *Hincks*.

*Hab.*: Connemara (*Brady*), Shetland (*Ald.*).

This species has the calycles about twice as large as the preceding.

3. *C. COSTATA*, *Hincks*.

*Hab.*: Whitby (*Hincks*).

The calycle of this species is divided into segments by two or three prominent ribs.



GENUS IV. SALACIA, *Lamouroux*.

*Stem* erect, composed of aggregated tubes branching. *Calycles* distributed on all sides of the stem and branches, cylindrical, sessile, without operculum, adnate for the greater part of their length.—T. H.

1. *S. ABIETINA*, *Sars*.

*Campanularia abietina* (*Sars*), *Grammaria robusta* (*Stimpson*), *G. ramosa* (*Ald., McA.*), *G. abietina* (*Sars*).

*Hab.*: Northumberland, Berwick Bay (*Ald.*), Shetland (*A. M. N.*). Height to 4 in.

This species somewhat resembles *L. dumosa*. The polypites are sulphur-coloured, with about 20 tentacles, and are able to withdraw not only into their calycles, but even into the stem. The calycles are arranged in four or five longitudinal rows round the stem.

*Sars* has fully described this species from specimens obtained on the Norwegian coast.

GENUS V. FILELLUM, *Hincks*. (*Filum*, a thread.)

*Stem* creeping, filiform, reticulate, immersed in a chitinous crust. *Calycles* tubular, decumbent, adherent, without operculum, irregularly disposed on the stem, to which they are attached at the base or by a short stalk.—T. H.

1. *F. SERPENS*, *Has*.

*Campanularia serpens* (*Has., P. H. G.*), *Capsularia serpens* (*Gray*), *Reticularia immersa* (*Wyville Thomson, P. H. G.*), *R. serpens* (*T. H., McA.*).

*Hab.*: Very common. Parasitic on zoophytes.

Described by Prof. Wyville Thomson in *Ann. of Nat. Hist.*, 2nd ser., xi. 443. "It is the common parasite of some of the larger Sertularians, and especially of *S. abietina*." The stem is very slender. The appearance

of the calyces may be seen from the generic description. The polypite is of a greenish colour.

#### FAMILY V. TRICHYDRIDÆ.

*Calyces rudimentary, tubular. Polypites cylindrical, very extensile, with a small conical proboscis.*—T. H.

GENUS TRICHYDRA, Wright. (θρίξ, hair, and hydra.)

*Stem* creeping, branched. *Calyces* as described above, given off at intervals from a creeping stem.—T. H.

1. T. PUDICA, T. S. W.

? Eudendrium pudicum (V. B.).

Hab.: Firth of Forth (T. S. W.). The polypite in this species is about  $\frac{1}{2}$  in. in height, and is able to extend its body and tentacles to a great extent. When extended it looks like a hair, hence its generic name.

Described in the Edinburgh New Philos. Journal for January, 1858, p. 6.

#### FAMILY VI. COPPINIIDÆ.

*Calyces united by an encrusting, cellular mass.*—T. H.

GENUS COPPINIA, Hassall.

*Zoophyte* consisting of a number of long tubular hydrothecæ crowded closely together and united by an adherent cellular mass, involving the lower portion, and leaving the upper portion free.—T. H.

1. C. ARCTA, Dalzell.

Sertularia arcta (Dal.), Coppinia mirabilis (Has.).

Hab.: Common. Parasitic on other zoophytes. The polypites “are not united at the base by a creeping

stem, but are bound together by a spongy mass, in which the calyces are plunged, as it were, for a considerable portion of their length. This mass adheres to the surface, and often encrusts the stem of various Sertularian zoophytes."—*Hincks*. The mass of the zoophyte is of a greenish-yellow colour. The calyces are like those of *L. dumosa*, but they are provided with an operculum.

#### FAMILY VII. HALECIIDÆ.

*Calyces biserial, subsessile, jointed to a lateral process from the stem. Polypites partially retractile.*—T. H.

##### GENUS I. HALECIUM, Oken.

*Zoophyte* plant-like, more or less branched, rooted by a creeping stolon. *Calyces* tubular or deeply campanulate. *Polypites* large and fusiform. *Reproduction* by means of fixed sporosacs.—T. H.\*

1. *H. halecinum*, Linn. Plate V. fig. 2.

*Sertularia halecina* (Linn., Pal., Esper, E. and S., Müller, Fabr., Turt., Bosc, Stew., Temp., Lamk., Flem.),  
*Thoa halecina* (Lamæ., De B., G. J., R. Q. C.).

Hab.: Very common. Height 4—10 in.

This is the "Herring-bone Coral" of Ellis. Its stiff, coarse appearance is shown in the figure. The main stems are compound and spring from a sponge-like, fibrous root. The zoophyte gradually tapers to a point. The calyces are alternate and tubular. The branches

\* Prof. Allman (Q. J. M. S., xiii. 55) states that in this genus proper hydrothecæ or calyces are suppressed, and that the sporosacs are modified segments of the stem. He applies the name *hydrophore* to the portions of the stem which support the polypites ("Gulf-Stream Hydroids," 15).

"are placed at a regular angle of 45 degrees from the stem, and so exactly proportionable is the distance of these branches from one another, that though they are placed alternately with respect to each other, yet the whole has at first sight the appearance of a herring bone. The tubes in the stems grow nearly parallel to each other, and in some one may count in a transverse section above one hundred."—*Ellis*. The calyces often consist of a number of tubular pieces fitted into each other, "marking the successive generations of poly-pites."

2. *H. MURICATUM*, *E. and S.*

*Sertularia muricata* (*E. and S.*, *Esper*, *Jameson*, *Turt.*, *Stew.*, *Bosc*, *Hogg*, *De B.*), *Laomedea muricata* (*Lamx.*), *Campanularia muricata* (*De B.*), *Thoa muricata* (*R. Q. C.*, *G. J.*).

Hab.: Wick, Firth of Forth (*C. W. P.*), Loch Ryan (*D. L.*), Northumberland (*Ald.*), Whitby (*Hincks*), Giant's Causeway (*Has.*), Montrose Bay (*A. S. P.*). Height 2—3 in.

This species is of a very coarse, rugged appearance. The stems and main branches are composed of agglutinated tubes. The gonothecæ are "globular, full of points from crested ribs, which sit on footstalks and arise from root-like tubes."—*E. and S.*

Dr. David Skene, of Aberdeen, first discovered this species. It has been called the "Sea Hedgehog Coralline."

3. *H. BEANII*, *Johnston*.

*Thoa Beanii* (*G. J.*).

Hab.: Common on shells and other zoophytes. Height 2—6 in.

"This species is more slender and graceful than *H.*

*halecinum*, and has little of the regular herring-bone appearance. The vesicles are different in form, resembling the flower of a calceolaria, or rather a wooden slipper without any leather on the sole. Only six days are required to bring the planula to maturity after its discharge from the vesicle."—*Landsborough*.

This species was discovered by Mr. Bean, of Scarborough, after whom it is named.

4. *H. LABROSUM*, *Ald.*

Hab.: Coast of Northumberland (*Ald.*), Moray Firth (*Macdonald*), Shetland, Wick (*C. W. P.*). Height 3—4 in.

This zoophyte is of a purplish colour when fresh, and is more lax in growth than *H. halecinum*. The pinnæ are ringed transversely above each joint. The calyces are large and open, with everted margins, and are annulated at the lower part.

This species was discovered by Mr. Alder, and described by him in *Ann. of Nat. Hist.*, 3rd ser., iii. 354.

5. *H. TENELLUM*, *Hincks*.

*H. labrosum*, Young (*Ald.*).

Hab.: Parasitic. Salcombe Bay, Devon; Filey (*Hincks*); Northumberland (*Ald.*). Height from  $\frac{1}{4}$ — $\frac{1}{2}$  in.

Described by Mr. Hincks in the *Ann. of Nat. Hist.*, 3rd ser., viii. 252.

This species is very slender. The calyces are funnel-shaped, often 4 or 5 one within another. The stems are ringed.

6. *H. PLUMOSUM*, *Hincks*.

Hab.: Ireland. Height 5 or 6 in.

Described by Mr. Hincks (*B. H. Z.*, 227) from a specimen at Trinity College, Dublin.

7. *H. GENICULATUM*, *Norman*.

8. *H. SESSILE*, *Norman*.

Hab.: The Minch, in deep water (*Norman*). Height  $1\frac{1}{2}$  in.

Both these species were described by Mr. Norman in a note on the "Hydrozoa of the Hebrides," in the Report of the British Association for 1866, 196.

GENUS II. OPHIODES, *Hincks*. (*ὀφιδῶδης*, snake-bearer.)

*Stem* branching, rooted by a creeping stolon. *Calyces* vase-shaped. *Polypites* not retractile within the calycle. *Body* deeply constricted below the base of the tentacles, which are in a single verticil, muricate, webbed, surrounding a conical proboscis. *Tentaculoid organs* borne singly on the stem and on the creeping stolon, highly extensile, protected at the base by a small chitinous cup, and terminated at the upper extremity by an enlarged capitulum armed with thread cells. *Reproduction* by means of fixed sporosacs.—  
T. H.

1. *O. MIRABILIS*, *Hincks*.

Hab.: Swanage Bay, Ilfracombe (*Hincks*). Height  $\frac{1}{8}$  in.

Described in Ann. of Nat. Hist. for November, 1866, 421. The general appearance will be seen from the generic description. The peculiarity of this species is the tentaculoid organ described in the generic character. It "consists of a very extensile, snake-like appendage, with an enlarged head attached at the lower extremity by an extension of the cœnosarc. They are capable of great elongation and contraction,



and are often three or four times the length of the polyp."—*Hincks*.

### FAMILY VIII. SERTULARIDÆ.

*Calycles perfectly sessile, more or less inserted in the stem and branches. Polypites wholly retractile, with a single wreath of filiform tentacles round a conical proboscis. Gonozoids always fixed.*—T. H.

GENUS I. SERTULARELLA, *Gray*. (Dimin. of *Sertularia*.)

*Zoophyte plant-like. Stem more or less branching, jointed, rooted by a creeping stolon. Calyces biserial, alternate, with a toothed orifice and an operculum composed of several pieces. Gonothecæ scattered, transversely ringed.*—T. H.

1. *S. POLYZONIAS*, *Linn.* Plate V. fig. 3.

*Sertularia flexuosa* (*Linn.*), *S. erecoides* (*Pal.*), *S. pin-nata* (*Templeton*), *S. hibernica* (*G. J.*), *S. Ellisii* (*M. Edw., G. J., R. Q. C.*), *S. polyzonias* (*E. and S., Linn., Esp., Lamk., Lamx., Flem., G. J., Dal., D. L., R. Q. C., P. H. G., McA.*), *La Sertulaire Zonée* (*De B.*), *Cotulina polyzonias* (*Ag.*).

*Hab.*: Generally distributed, on shells, seaweeds, &c. Stem slender, straw-coloured, irregularly branched. Calyces alternate and distant, urceolate. Aperture wide, with 4 teeth. Gonothecæ ovate, wrinkled, with 4 teeth at the orifice. Polypite with about 20 tentacles.

This is the "Great Tooth Coralline" of Ellis ("Corallines," 5), who says, respecting it, "There are two kinds of this coralline, the one upright, the other more branched and climbing. When this coralline was put into sea water, I observed through the microscope a polyp occupy the inside of the whole, and

each denticle or cell filled with part of it, ending in tufts of tentacula. A small piece of one of the sprigs was put into a watch-glass of sea water, and, notwithstanding the separation of its body, in five minutes' time the claws or tentacula were moving about in search of prey."

2. *S. GAYI*, Lamx. Plate V. fig. 4.

*Sertularia Gayi* (Lamx., T. H., Ald., McA.), *S. ericoides*, var. (Pal.), *Sertulaire de Gay* (De B.), *S. polyzonias*, var.  $\beta$ . (G. J.).

Hab.: Cornwall (T. H.), Plymouth (A. S. P.), Isle of Wight (Solander), Norfolk and Suffolk (C. W. P.), Durham and Northumberland (Ald.), Shetland (A. M. N.), Dublin Bay. Height 4—10 in.

This species has been considered allied to the preceding, but it is in every way much coarser and stouter. The aperture of the calycle is 4-toothed, that of the gonotheca has 2 teeth.

3. *S. TRICUSPIDATA*, Ald.

*Sertularia tricuspidata* (Ald., McA.), *S. ericoides* (Esper).

Hab.: North-east coast (Ald.), Seascale (A. S. P.). Height 2 in.

Described by Mr. Alder, North. and Dur. Cat. in Trans. Tynes, F. C., iii. 111. Stem slender, light-brown, branched. Calycles cylindrical. Gonothecæ ribbed, with a "funnel-shaped" aperture. "The rim of the aperture of the calycle rises into three strong denticles, the largest in front, the other on the sides."

4. *S. RUGOSA*, Linn. Plate VI. fig. 1.

*Sertularia rugosa* (Linn., Pal., Esp., E. and S., Fabr., Flem., Lamk., G. J., D. L., P. H. G., McA.), *Clytia rugosa* (Lamx., Temp.), *Sertularia patagonica* (D'Orb.),



*Amphitrocha rugosa* (Ag.), *Campanulaire rugueux* (De B.).

Hab.: Common. Usually parasitic on *Flustra foliacea*. There is an erect variety which grows to a height of nearly an inch, but the smaller variety is very common on *Flustra*. To the naked eye it appears merely as a brown thread, knotted here and there, hardly distinguishable in colour from its host, but on examination with the microscope the knots are resolved into curiously wrinkled cells, "like little barrels." The gonothecæ are similar in shape to the calyces, but larger, and they have 3 teeth in the opening on the top of each. This species is the "Snail Trefoil Coralline" of Ellis ("Corallines," 26). He describes the cells as "furrowed like the seed-vessels of the plant called the Snail Trefoil."

5. *S. TENELLA*, Ald.

*Sertularia rugosa*, var. *a.* (G. J.), *S. tenella* (Ald., McA.).

Hab.: Northumberland (Ald.), South Devon, Filey (Hincks), Peterhead, Wick (C. W. P.), Hebrides, Shetland (A. M. N.).

Described by Mr. Alder in the North. Cat. in Trans. Tynes, F. C., iii. 113. The calyces are barrel-shaped, with a 4-toothed aperture. "It is smaller and more delicate than *S. rugosa*. The polypites appear to be yellow or orange colour."

6. *S. FUSIFORMIS*, Hincks.

Hab.: South Devon, Ilfracombe (Hincks), Torbay (Parfitt), Hebrides (Norman). Height  $\frac{1}{4}$ —1 in. Stem slender, ringed at base and below each calyx. Calyces flask-shaped, smooth, aperture 4-toothed, one to each internode.

Described in the Ann. of Nat. Hist. (3rd ser.), viii. 253. "Its nearest ally is *S. tenella*. It is one of the company of pigmy forms, as exquisite as they are minute, which reward a diligent search amongst the chinks and crannies of the tidal pools."

## GENUS II. DIPHASIA, Agassiz.

*Zoophyte* plant-like. *Stem* more or less branching, rooted by a creeping stolon. *Calycles* opposite, a pair in each internode, occasionally subalternate, with an internal valve-like operculum. *Gonophores* scattered, more or less cleft or divided into segments.—T. H.

### 1. D. ROSACEA, Linn.

*Sertularia rosacea* (Linn., Esp., E. and S., Lamk., Temp., G. J., R. Q. C., D. L., P. H. G., McA.), *S. nigellastrum* (Pal.), *Dynamena rosacea* (Lamx., Flem., De B.).

**Hab.:** Generally distributed. Height from 1—2 in. Stem whitish, branches alternate. Calycles tubular, with a free portion standing out from the stem. Female gonothecæ pear-shaped, with "8 longitudinal ridges terminating in spinous processes of various lengths." This species is parasitic on fuci and zoophytes, and is said to be more graceful on the latter than on the former.

This is the "Lily or Pomegranate Flowering Coralline" of Ellis ("Corallines," 8). He says of the gonothecæ that "when magnified they are shaped like a lily or pomegranate flower just opening, and appear more like a blossom than any belonging to the whole tribe of corallines."

### 2. D. ATTENUATA, Hincks.

*Sertularia rosacea* (*Ellis, G. J.*), *S. pinaster*, var. (*G. J.*), *S. attenuata* (*T. H.*).

Hab.: Ilfracombe, Swanage, Filey, Whitby (*Hincks*), Brighton (*Ellis*).

This species may be distinguished from the preceding "by its more erect and stiffer habit, and by its decided horn colour, contrasting with the pearly whiteness of *D. rosacea*."—*Hincks*. In addition there is often a tendril-like expansion of the stem.

3. *D. FALLAX*, *Johnston*.

*Dynamena pinnata* (*Flem.*), *Sertularia pinnata* (*G. J.*), *S. fallax* (*G. J., D. L., P. H. G., McA.*).

Hab.: North of England and Scotland. Height to 2 in. Stem thick. Calyces tubular, with wide plain margin. Gonothecæ bearing 4 erect spines, surrounding a tubular orifice.

The peculiarity of this species consists in the number of tendrils, which are "curled and thickened at the extremities," and which are extended from the ends of many of the branches. These tendrils serve the purpose of attaching it to other zoophytes, upon which it is parasitic. The colour is white when living, becoming dark on death.

4. *D. PINASTER*, *E. and S.*

*Sertularia pinaster* (*E. and S., G. J., Ald., D. L., P. H. G., McA.*), *Dynamena pinaster* (*Lamx.*), *S. margareta* (*Has., G. J., T. H., D. L., P. H. G., McA.*), *Diphasia margareta* (*Ag.*).

Hab.: Widely distributed. Height 2–6 in.

This is the "Sea-pine Coralline" of *E. and S.* It is pearly white in colour when living, becoming light horn-colour when dried. The calyces are tubular, with plain apertures projecting from the stem. The gono-

thecæ are four-cornered above, with a distinct spine at each of the corners.

5. *D. TAMARISCA*, *Linn.* Plate VI. fig. 2.

*Sertularia tamarisca* (*Linn.*, *Pal.*, *E. and S.*, *Lamx.*, *Lamk.*, *G. J.*, *D. L.*, *R. Q. C.*, *P. H. G.*, *McA.*), *Dynamena tamarisca* (*Flem.*, *De B.*).

Hab.: Widely distributed.

This is the "Sea Tamarisk" of Ellis ("Corallines," 4), who says, "Its ramifications are irregular, but chiefly alternate; its texture is of a thin, transparent, horny nature; the denticles or cells are large, cylindrical, open and opposite, and each pair seems fixed in the top of the next pair below it. The vesicles (gonothecæ) appear to be shaped like a heart with a short tube, not unlike the *aorta*, cut off." The calyces have tridentate apertures.

6. *D. PINNATA*, *Pallas.* Plate VI. fig. 3.

*Sertularia pinnata* (*Pal.*, *G. J.*, *D. L.*, *R. Q. C.*, *P. H. G.*, *McA.*), *S. fuscescens* (*Turt.*, *Lamx.*, *Stew.*), *S. nigra* (the female) (*Pal.*, *G. J.*, *D. L.*, *P. H. G.*, *McA.*), *Dynamena pinnata* (*Flem.*), *Dynamène brunâtre* (*De B.*), *Diphasia nigra* (*Ag.*), *Nigellastrum nigrum* (*Oken*).

Hab.: Cornwall (*Pal. and Couch*), Devon (*Mrs. Griffiths*), Scarborough (*Bean*). Height 7—8 in. Stems straight, serrated. Branches alternate, tapering towards the point of origin. Calyces subalternate, tubular, with wide margin. Gonothecæ ovate, with an aperture surrounded by short teeth.

"To see this in all its beauty it must be examined in a living state, when, instead of being black (as it becomes when dried), it will be found to be of a beautiful and delicate pink, and in some instances of a deep

arterial blood-colour. It is the stoutest and most rigid of all our native Sertularidæ."

7. *D. ALATA*, *Hincks*.

*Sertularia alata* (*McA.*).

Hab.: Shetland, Hebrides (*A. M. N.*), Falmouth (*Cocks*), Cornwall (*Peach*). Height 3—5 in.

Described in the Annals and Magazine of Nat. Hist. for February, 1855.

Colour blackish-brown with a highly polished appearance. Stem pinnate. Branches alternate. Calyces small, the free portion abruptly standing out from the stem.

GENUS III. SERTULARIA, *Linnæus* (*in part*).

*Zoophyte* plant-like. *Stems* more or less branching, jointed, rooted by a creeping stolon. *Hydrothecæ* biserial, opposite or alternate, without external operculum. *Gonothecæ* scattered, with a simple orifice and without an internal marsupium.—T. H.

1. *S. PUMILA*, *Linn.* Plate VII. fig. 1.

*S. piccina* (*D. Chiage*), *Dynamena pumila* (*Lamx., Flem., Ag.*), *D. naine* (*De B.*).

Hab.: Common. Height generally about  $\frac{1}{2}$  in.

This common zoophyte is found as a parasite on *fuci*, which are sometimes almost covered by its dense growth. The calyces are opposite, and the appearance of the zoophyte is that of a number of V's or inverted triangles strung together. Between each pair of calyces is a joint, which divides the stem into short internodes. The occurrence of this joint, however, varies considerably. It is often more or less, sometimes entirely, obliterated, and often occurs between each two pairs of calyces. If an internode in a Sertu-

larian bear two calycles, it is an internode of the first order; if it bear four, of the second order; and so on. In *S. pumila* and in the next species, *S. gracilis*, the internodes are of the first and second orders. *S. pumila* is often found branched, and in that case may grow to an inch or more in height. This species is the "Sea-oak Coralline" of Ellis ("Corallines," 9), so called from being found by him on the sea-oak *fucus*. It is one of the phosphorescent species, this quality having been noticed by nearly all zoophytologists.

2. *S. GRACILIS*, *Has.*

*S. pumila*, var.  $\beta$ . (*J. G.*).

Hab.: Brighton (*Has.*), Norfolk (*C. W. P.*), Swanage Bay (*T. H.*), Durham, Shetland (*Nor.*), Blackpool, Bangor (*A. S. P.*). Height  $\frac{1}{2}$  in.

This has generally been considered a dwarf variety of the preceding. G. Winther has recently argued in favour of this view.\* There appears to be little difference between the species, the present one being, however, smaller and with more slender and lengthened internodes than *S. pumila*.

3. *S. OPERCULATA*, *Linn.* Plate VII. fig. 3.

*S. usneoides* (*Pal.*), *Dynamena operculata* (*Lamx., Flem., De B.*), *D. pulchella* (*D'Orb.*), *Amphesbetia operculata* (*Ag.*).

Hab.: Generally distributed. Height several inches.

This species is exceedingly graceful and beautiful. "Sea Hair" was the name which Ellis gave to it, and well does it express its delicate habit and growth. The gonothecæ are profusely distributed over the zoophyte, and reminded the early naturalists of the capsules of mosses, and, says Dr. Johnston, induced "the botanists

\* See J. R. M. S., 1880, 462.



to draw an additional argument in behalf of the vegetability of the corallines themselves; and a Darwinian might be perhaps forgiven, were he even now to feign how the Nereids stole them from the mossy habitats of Flora's winter and vernal sheds, to deck and gem the arbuscular garniture of their coral caves." The calyces are very small, and are sharply pointed at the end. They have also a small acute projection on each side. The internodes are of the first order, but vary in length. There is a small calycle at the axils of the branches. The capsules are closed by hinged opercula.

4. *S. FILICULA*, *E. and S.*

*S. abietina*, var.  $\beta$ . (*Pall.*), *Dynamena filicula* (*Flem.*).

Hab.: Widely distributed. Liverpool, Oban (*T. H.*), Bangor, Seascale, Filey, plentiful (*A. S. P.*). Height 1—4 in.

This is the "Fern Coralline" of Ellis and Solander. In appearance and mode of growth it much resembles *S. abietina*, but the latter is much larger and coarser. The calyces are flask-shaped. They are not directly opposite, but are subalternate. The internodes are of the first order (i.e. two calyces to each). As in the last species, there is an axillary calycle at each branch. The stems are bent at alternate angles, from which the pinnæ arise.

The appearance of this species is very graceful. The colour is a bright straw, and the growth is very diffuse. The name of *E. and S.* is very appropriate.

The gonothecæ are pear-shaped. They are rarely produced. Ellis, however, with his accustomed accuracy and research, observed and figured them. Mr. McIntosh (*St. Andrew's Fauna*) states that he has found this species in the stomach of the cod.

5. *S. ABIETINA*, *Linn.* Plate VIII. fig. 2.

*Dynamena abietina* (*Flem.*), *S. sapinette* (*De B.*), *S. abietinula* (*Dal.*).

Hab.: Generally distributed. Height to 12 in.

This species much resembles the preceding in habit. It is, however, much coarser and larger in every way. There are no internodes, and the calyces are more distinctly alternate. They are described by Dr. Johnston as "bellied at the base with a narrow, everted neck and plain aperture, so as to resemble a Florence flask." The mode of growth is peculiar. The main stem as well as the pinnæ bear calyces. The stem is regularly bent at angles, from each of which spring alternate branches or pinnæ, which decrease in length towards the apex. Here and there the pinnæ are much lengthened and become themselves pinnate, and these secondary pinnæ are often again similarly branched. These lengthened pinnæ, conspicuous amongst the smaller and simple ones, present a very curious appearance.

This species is the "Sea Fir" of Ellis ("Corallines," 4).

6. *S. ARGENTEA*, *E. and S.* Plate VII. fig. 2.

*S. cupressina* (in part), (*Linn.*, *Pall.*, *Esper.*), *S. fastigiata* (*Fabr.*), *Dynamena argentea* (*Flem.*).

Hab.: Generally distributed. Height 6—18 in.

The beauty of this species cannot well be exaggerated. Ellis named it the "Squirrel's Tail Coralline," and its gracefully curved and luxuriant growth could hardly be suggested by a better name. The main stem is of a dark brown colour regularly waved, giving off at about equal intervals panicles of branchlets from different sides of the stem. Two branchlets arise from



each wave, and there are four or five to each spiral. These branchlets are divided and subdivided, and bear alternate calyces which are pointed and turn a little inwards "like the horns of a bull" (*Ellis*). These are also borne on the main stem. When the zoophyte exceeds 12 inches in height, the lower part of the stem becomes bare. The internodes of the branchlets vary considerably, containing sometimes 2, sometimes 4, and sometimes 6 calyces. The gonothecæ have a circular aperture, and are surmounted by one or two spines.

7. *S. CUPRESSINA*, *Linn.*

*S. cyprès* (*De B.*), *S. argentea* (*Dal.*), *Dynamena cupressina* (*Flem.*).

Hab.: Widely distributed in deep water. Height about 1 foot. Mr. McIntosh has found at St. Andrew's a branched variety 18 in. high.

This species has been often asserted to be identical with the preceding. Pallas and Linnæus regarded them as the same, and Dalyell, Fleming, and Johnston, were inclined to agree with them. Dr. Landsborough considered that they "ran into each other." On the contrary, Ellis, Hassall, Thompson, and Bean, considered them distinct, and in this opinion they are followed by Mr. Hincks.

*S. cupressina*, or the "Sea Cypress" of Ellis, is much stouter than *S. argentea*. The stem is thicker and the branches longer and narrower. The branches are also much lighter coloured. The calyces also are different, having a bilabiate mouth (i.e. divided at the aperture, so as to form two denticles). There are usually three pairs of calyces to each internode, although internodes of the second, and even of the first or fourth order, are found to occur.

8. *S. ARGENTELLA*, *Pennington*. Plate VIII. fig. 1.

Hab.: Menai Straits. Attached to roots of *Laminaria* (*A. S. P.*). Height about  $\frac{3}{4}$  in.

This species bears the same relationship to *S. argentea* that *S. filicula* does to *S. abietina*. It is small and delicate in growth, not exceeding  $\frac{3}{4}$  in. in height.

The branches are closely set, alternate, and furcate. The calyces are somewhat pointed in shape. There are four of them to an internode, and one in the axis between the branches.

The reproductive organs were not on any of the specimens obtained by me.

#### GENUS IV. SELAGINOPSIS, *Allman*.

*Stem* consisting of a single axile tube to which the calyces are adnate, and on which they are disposed in several longitudinal rows.—*All*.

This genus was established by Prof. Allman\* for a Japanese species which he called *Selaginopsis fusca*. The Rev. A. M. Norman (*A. N. H.*, March, 1878) considers the genus as characterized above to include the *S. fusca* of Allman and the *Sertularia fusca* of Johnston. The former of these he therefore calls *S. Allmani*, retaining "*fusca*" for Dr. Johnston's species.

*S. FUSCA*, *Johnston*.

*Sertularia nigra* (*Jameson*, *R. Q. C.*, *G. J.*), *Dynamena nigra* (*Flem.*), *D. noire* (*De B.*), *Sertularia fusca* (*G. J.*, *D. L.*, *T. H.*), *Diphasia fusca* (*Ag.*), *Nigellastrum fuscum* (*Gray*).

Hab.: On the north-east coast only. Rare. Height 3 in. The stem of this zoophyte is of a blackish-brown

\* *Linn. Soc. Journ.*, xii. (1876), 272.

varnished colour, and from the closely packed and crowded character of the calyces appears to be quadrangular. The calyces, instead of being placed on the face of the branch, as in *Sertularia*, are inserted in the side. The gonothecæ are pyriform and borne as in the preceding genus.

GENUS V. HYDRALLMANIA, *Hincks*.

Zoophyte plant-like. Stem bearing plumous branches, jointed, rooted by a filiform stolon. *Hydrothecæ* unilateral, arranged in distinct companies, each of which occupies an internode. *Gonothecæ* scattered, with a simple, inoperculate aperture.—T. H.

1. *H. falcata*, *Linn.* Plate VIII. fig. 3.

*Sertularia falcata* (*Linn.*, *Pall.*, *E. and S.*, *Bosc.*, *Berk.*, *Turt.*, *Stew.*), *Aglaophenia falcata* (*Lamæ.*), *Plumulaire en faux* (*De B.*), *Plumularia falcata* (*Lamk.*, *Flem.*, *Grant*, *Temp.*, *Dalyell*, *G. J.*, *R. Q. C.*, *P. H. G.*, *D. L.*, *McA.*), *Pennaria falcata* (*Oken*).

Hab.: Common. Height 1 foot and upwards.

This widely distributed but graceful zoophyte, to which Ellis gave the name of "Sickle Coralline," rises from a root-like stolon by a spirally twisted dark brown stem, regularly jointed at intervals, from which branches are given off above each joint, which branches bear calyces and alternate pinnæ. These pinnæ bear calyces on one side only, which are pressed together so as to appear as if overlapping. The pinnæ are regularly divided into internodes, each of which bears 5 to 7 calyces. The branches when dried curl up into the form of a sickle, whence the name given by Ellis. In the frontispiece to Ellis's "Corallines" is a curious

picture of a group of zoophytes, and a tall specimen of *H. falcata* makes a prominent object in the centre of the group.

GENUS VI. THUIARIA, *Fleming*. (*thua*, a cedar.)

*Zoophyte* plant-like. *Stem* branching, jointed, rooted by a filiform stolon. *Hydrothecæ* biserial, imbedded in the substance of the stem and branches.—T. H.

1. T. THUJA, *Linn.* Plate IX. fig. 1.

*Sertularia thuja* (*Linn.*, *Pall.*, *Esp.*, *E. and S.*, *Fabr.*, *Lamx.*, *Stew.*, *Hogg*), *Cellaria thuja* (*Lamk.*, *Stark*), *Nigellastrum thuja* (*Oken*), *Biseriaria thuia* (*De B.*).

Hab.: North-east coast of Scotland and England. Height to 14 in.

"The fishermen have given them the name of Bottle Brushes."—*Ellis*.

This zoophyte has an erect, filiform, zigzag stem, surmounted by a tuft of short branches arranged so as to form whorls round the stem. (Four branches form a whorl). As the stem grows the lower whorls decay and fresh ones shoot out above, so as always to preserve the "bottle-brush" appearance. The colour is dark horn. The cells are alternate, closely pressed, and arranged in two rows. They taper towards the orifice.

Mr. McIntosh (St. Andrew's Fauna) has found specimens of the species with a short secondary stem.

2. T. ARTICULATA, *Pallas*.

*Sertularia articulata* (*Pall.*, *Esp.*), *S. lonchitis* (*E. and S.*), *Cellaria lonchitis* (*Lamk.*), *Nigellastrum articulatum* (*Oken*), *Sertularia lichenastrum* (*Lamx.*, *Berk.*, *Stew.*), *Biseriaria articulata* (*De B.*).

Hab.: Dublin Harbour (*Ellis*), Scarborough (*Bean*),

Devon (*T. H.*), Northumberland (*Ald.*), Wick (*C. W. P.*), Isle of Man (*Forbes*), North of Ireland (*Thompson*), Blackpool, the Mersey (*A. S. P.*). Height 4—6 in.

This is the "Sea Spleenwort or Polypody" of Ellis. It has "two rows of straight, hollow branches a little compressed, which are placed on the middle stem opposite to each other in a parallel and alternately pinnated form, like the leaves of Polypody."—*Ellis*. Upon these branches the cells are placed in a double row, apparently sunk into the branch. The stem is of a dark horn colour, and regularly jointed between each pair of branches, which do not seem to be continuations of the stem, but to be jointed to it.

#### FAMILY IX. PLUMULARIDÆ.

*Hydrothecæ sessile and unilateral. Zoophyte furnished with nematophores (minute calyces containing an extensile offshoot from the cænosarc and frequently bearing thread cells). Polypites with a single wreath of filiform tentacles round a conical proboscis. Gonozooids always fixed.*—*T. H.*

This is the first hydroid family upon which a report has been issued in connection with the "*Challenger Expedition*." Prof. Allman, who is investigating the hydroids of that collection, has (part xx. *Challenger Reports*), in his report on the *Plumularidæ*, fully described the characteristics of the family; and I have, therefore, in the following descriptions adopted the divisions and genera favoured by him.

The family is divided as follows:—

|                                      |                     |                                               |                                   |
|--------------------------------------|---------------------|-----------------------------------------------|-----------------------------------|
| Movable nematophores always present. | ELEUTHERO-<br>PLEA. | Gonophores with special protective apparatus. | ELEUTHEROPLEA<br>PHYLLACTOCARPA.* |
|                                      |                     | Gonophores destitute of protective apparatus. |                                   |
| Movable nematophores never present.  | STATOPLEA.          | Gonophores with special protective apparatus. | STATOPLEA PHY-<br>LACTOCARPA.     |
|                                      |                     | Gonophores without protective apparatus.      |                                   |

To the *Eleutheroplea gymnocarpa* belong the genera *Antennularia* and *Plumularia*. To the *Statoplea phyllactocarpa* belong the genera *Aglaophenia* and *Lyptocarpus*; and to the *Statoplea gymnocarpa* belongs the genus *Halicornaria*.

The *nematophores* (so named by Mr. Busk, Hunterian Lectures, 1857) are a peculiarity of this family. Their use has been investigated by Prof. Allman (A. N. H., ser. 3, xiii. 1864, *Gymnoblastic Hydroids*, and *Challenger Reports*, part xx. 1883), by Mr. Hincks (B. H. Z., xviii.), by Dr. Von Lendenfeld (A. N. H., October, 1883), Dr. Metschnikoff, and others; and they seem to be able to eject their contents in the form of "fine granular processes, very extensile and mutable, which have been seen to invest the zoophytes as with gossamer-like threads, and then to be again withdrawn into the calycle." They usually contain thread cells.

The *nematophores* are movable in the *Eleutheroplea*, but not in the *Statoplea*. In the latter group there

\* There are no British species of this section.



are three of the fixed nematophores to each calycle, one above called the *mesial* one and two *lateral* ones. In addition to the nematophores borne on the calycles and ramuli, there are in many species others borne on the stem (*cauline*), and in the *Statoplea phylactocarpa* borne on the protective cases (*gonosomal*).

Mr. Hincks, in his "British Hydroid Zoophytes," states that in the genus *Aglaophenia* the nematophores are appendages of the calycles only. Their presence, however, can be clearly made out on the stems in many species of that genus.

Dr. Von Lendenfeld (*ubi sup.*) divides the contents of the nematophores (*machopolyps*) into three groups, viz. 1. Guard animals with urticating capsules (as in *Plumularia*); 2. Guard animals with adhesive cells (as the lateral nematophores of *Aglaophenia*); and 3. Guard animals with urticating capsules and adhesive cells (as the mesial nematophores of *Aglaophenia*).

Dr. Von Lendenfeld considers the purpose of the guard polyps to be to assist in seizing the zoëæ and other larvæ upon which the zoophytes feed, and thinks that they have a numbing action, as when once touched the "zoëa vainly tries to escape." He also considers the machopolyps serviceable for defence against annelids and other larger animals.

Dr. Metschnikoff's researches have been referred to on page 33.

#### SUB-DIVISION. *ELEUTHEROPLEA GYMNOCARPA.*

##### GENUS I. ANTENNULARIA, *Lamarck.*

*Zoophyte* plant-like. *Stems* simple or branching, jointed, clothed with verticillate branchlets, and rooted

by a mass of fibres. *Calycles* cup-shaped. *Nematophores* movable, bithalamic, distributed along the stem. *Gonothecæ* axillary, unilateral.—T. H.

1. A. ANTENNINA, *Linn.* Plate IX. fig. 2.

*Sertularia antennina* (*Linn.*, *Pall.*, *Esp.*, *Stew.*), *Nigellastrum antenninum* (*Oken*), *Nemertesia antennina* (*Lamx.*), *Antennularia indivisa* (*Lamk.*), *A. simplex* (*De B.*).

Hab.: Generally distributed. Height 8—12 in.

This zoophyte was called by Ellis the "Lobster's Horn Coralline or Sea-beard," from its appearance when stripped of its branchlets, which are easily detached. The colour is yellowish-brown, and the stems rise in numbers from a common root-like base. The stems are jointed at very short intervals, each joint bearing a number of short processes, to which the pinnules or branchlets are attached. These branchlets (hair-like in appearance) curve inwards and upwards. They are divided into internodes, which are alternately long and short, the latter not bearing any calycles. The nematophores are numerous, being found above and below each calycle and on the intervening internode.

There is a red variety of this species sometimes found.

2. A. RAMOSA, *Lamarck.*

*Sertularia abietina*, var. *β.* (*Linn.*), *Nemertesia ramosa* (*Lamx.*), *Sertularia seticornis* (*Hogg*), *Antennularia arborescens* (*Hass.*), *A. rameuse* (*De B.*).

Hab.: Abundant. Height 8—10 in.

This species has been classed by many observers with the preceding, but the differences are striking. *A. ramosa* is much stouter than its ally, has the joints



on the stem closer, and the branchlets more numerous, straighter, and longer. Amongst the microscopic characters the most noticeable is that the internodes of the branchlets are equal in length, and all bear calyces.

GENUS II. PLUMULARIA, *Lamarek (in part)*.

*Zoophyte* consisting of plumous shoots, simple or branched, jointed, attached by a creeping stolon. *Hydrothecæ* cup-shaped. *Nematophores* movable, distributed along the stem and branches. *Gonothecæ* always unenclosed, differing in the two sexes.—T. H.

1. *P. PINNATA*, *Linn.*

*Sertularia pinnata* (*Linn.*, *E. and S.*, *Berk.*, *Turt.*, *Stew.*, *Bosc.*), *Aglaophenia pinnata* (*Lamæ.*).

Hab.: Generally distributed. Height 1—7 in.

This is the "Jointed Sea-bristle Coralline" of *E. and S.* It is described by Dr. Johnston as "very delicate, white or rarely horn colour, simple, plumous, and pretty."

Dr. Landsborough describes the surprise of the Arran boatmen, who were astonished at his caring for the dredged zoophyte in its collapsed state, on his plunging it into clear water and showing it to them in all its beauty. "They did not think there had been anything so bonny in the whole bay." The calyces, which appear like a plain glass tumbler, are inserted in the pinnæ, one to each internode. The nematophores, which are cup-shaped, are attached to each internode, one being placed just below the insertion of the calycle.

2. *P. SETACEA*, *Ellis.* Plate IX. fig. 4.

*Corallina setacea* (*Ellis*), *Sertularia pinnata*, var.  $\beta$ .

(*Linn.*), *S. setacea* (*Pall., E. and S., Stew., Hogg*), *Aglaophenia setacea* (*Lamouroux*), *Pennaria setacea* (*Oken*).

Hab.: Generally distributed. Height 1—1½ in.

This is the "Little Sea-bristle Coralline" of E. and S. It somewhat resembles the preceding species in general appearance, but is only half the size. It is very delicate, and "its faint shadow cast by the strong light of the summer day on the rock from which it springs, is often the only indication of its presence to the collector." There are two joints between each calycle in this species. The nematophores are numerous, there being four to each calycle, one pair side by side above it, and another pair in a line below it.

3. *P. CATHARINA*, *Johnston*.

*Aglaophenia Catharina* (*Gray*), ? *Sertularia secundaria* (*Cavolini*).

Hab.: Generally distributed in deep water. Height 3 or 4 in. Mr. McIntosh (*St. Andrew's Fauna*) has found this as high as 7 in.

This species grows in clusters, and is remarkable for the fact that the pinnæ are exactly opposite. The nematophores are also highly developed, and those attached to the sides of the calycles are mounted on peduncles. The internodes on the pinnæ bear alternately calycles and sessile nematophores, the calycles being separated by two joints.

Dr. Johnston named this species after his wife. He says, "To this very distinct and elegant species I have taken the liberty of assigning the Christian name of the lady to whom this work (*His. B. Z.*) is indebted for by far the greater part of its illustrations." And "to whom," adds Dr. Landsborough, "under God, he

was indebted for much of the happiness of his life.  
*Ter felices et amplius, &c."*

4. *P. ECHINULATA*, Lamarck.

*Sertularia setacea* (Lister).

Hab.: Not uncommon. Height  $\frac{3}{4}$ —1 in.

This species much resembles outwardly *P. setacea*, but differs much in its smaller size and in several microscopic particulars. The calyces occur on every internode, and have a nematophore above and below each. The gonothecæ are ornamented with spinous processes of considerable length.

5. *P. SIMILIS*, Hincks.

*P. setacea* (D. L.).

Hab.: South Devon, Isle of Man (Hincks). Height  $1\frac{1}{2}$  in.

This name is given by Mr. Hincks to the species figured as *P. setacea* by Dr. Landsborough (Pop. Hist., plate ix. figs. 26, 26a). It is rather larger than the preceding species, which, however, it much resembles. The calyces are free at the extremity, and are separated by two joints, a bare internode occurring between the calyces, each of which has a single nematophore below it.

6. *P. OBLIQUA*, Saunders.

*Laomedea obliqua* (Saunders, G. J., D. L., P. H. G.),  
*Campanularia* (Lister).

Hab.: Brighton and South-eastern District. Height  $\frac{1}{4}$  in.

Described by Mr. Hincks (A. N. H., 3rd ser., viii. 258).

This minute species bears only one calycle on each pinna. The gonothecæ are many times the size of the calyces. There are two nematophores above, and one below each calycle.

7. *P. SILIQUOSA*, *Hincks*.

Hab.: Guernsey.

Described in A. N. H., February, 1877.

This species, so far as known, is a stemless form, each zoophyte being in appearance like a branch of one of the pinnated forms. The female calyces are long and pod-like.

8. *P. HALECIOIDES*, *Alder*. Plate IX. fig. 3.

Hab.: Cullercoats (*Ald.*), Shetland, Ilfracombe (*Hincks*). Height 1 in.

"This is a singularly delicate and beautiful species."

The pinnæ are alternate, one to each internode of the stem, into which they are set as into joints. The pinnæ are themselves jointed, and bear few calyces, separated by two or three internodes. Each calyx has a nematophore above and below it, and encloses a polypite, shaped like an hour-glass, with a wreath of about 20 tentacles, which can be waved in all directions. The length of the pinnæ vary, gradually shortening towards the apex. The pinnæ never bear more than 3 or 4 calyces, the number regularly decreasing to the uppermost pinna, which bears one.

9. *P. FRUTESCENS*, *E. and S.*

*Sertularia Gorgonia* (*Pall.*), *S. frutescens* (*E. and S.*, *Turt.*, *Bosc*, *Stew.*, *Hogg*), *Aglaophenia frutescens* (*Lamk.*), *Pennaria fruticans* (*Oken*).

Hab.: In deep water, rare. St. Andrew's (*McI.*). Height 5—6 in. (11 in., *McI.*)

This is the "Shrubby Coralline" of *E. and S.* "The stem is black and hard, full of small united tubes, from which come forth rows of small branches disposed alternately in a pinnated order, bending upwards.

The denticles (calyces) are of a cylindrical, bell-shaped form."—*E. and S.*

The pinnae themselves bear short branchlets, which are usually bifid. There are two nematophores above and one below each calycle. There are from one to three calyces to each internode.

10. *P. CORNUCOPLÆ*, *Hincks.*

Hab.: Captnoe, Ilfracombe (*Hincks*). Height  $\frac{3}{4}$  in.

This was described by Mr. Hincks in the A. and M. of Nat. Hist. (4), x. 389. The plumes rise at intervals from a creeping stolon, and are regularly jointed, giving off pinnae at each joint, which are either opposite or alternate. The calyces are cup-shaped, and separated by two joints. The sarcothecæ are placed one on each side of the calycle above and one below it, and one on each of the internodes of the pinnae.

The female gonophores are horn-shaped, with the curve towards the calyces, from the base of which they arise.

#### SUB-DIVISION: *STATOPLEA PHYLACTOCARPA.*

GENUS III. *AGLAOPHENIA*, *Lamouroux (in part).*

*Shoots* plumose, simple or branched, rooted by a filiform stolon. *Hydrothecæ* cup-shaped or tubulous, usually with an intrathecal ridge. *Nematophores* fixed, two lateral and one mesial in connection with each calycle. *Gonotheccæ* collected in corbulæ.—*Allman.*

The *corbula* referred to is "a pinna modified so as to form a protective envelope for the gonotheccæ." See Plate X. fig. 2.

1. *A. PLUMA*, *Lamarck.* Plate IX. fig. 5.

*Sertularia pluma* (*Linn., Pall., Esper., Lister, E. and*

*S.*, *Stew.*), *Plumularia cristata* (*Lamk.*, *Temp.*, *G. J.*, *R. Q. C.*, *D. L.*, *McA.*), *P. pluma* (*Flem.*, *De B.*, *P. H. G.*), *Pennaria pluma* (*Oken*).

Hab.: Ayrshire (*D. L.*), Filey (*T. H.*), Isle of Man (*T. H.*), Jersey (*A. M. N.*), South Devon (*T. H.*), Menai Straits (*A. S. P.*). Height to 3 in.

This is a very graceful little zoophyte. The shoots are simple, divided into internodes with alternate pinnæ. The calyces are cup-shaped and closely packed on the upper side of the pinnæ; they have a toothed margin. The lateral nematophores are small; the mesial one is well developed, but does not project much beyond the calycle.

This is the "Podded Coralline" of Ellis. This name he seems to have given in consequence of his observations on the "corbulæ," which he likened to seed-pods. The calyces he likened to the flowers of the "lily of the valley."

## 2. *A. TUBULIFERA*, *Hincks*.

*Plumularia cristata*, var. (*R. Q. C.*, *G. J.*).

Hab.: Cornwall, Oban (*Hincks*), Hebrides (*A. M. N.*). Height 2—3 in.

This is a larger but more delicate species than the preceding, to which it bears, however, a great resemblance. The lateral nematophores are prominent and projecting. The corbulæ are "furnished with an expanded, spur-like process, with serrated edges springing from the base at one side."

## 3. *A. PLUMOSA*, *Pennington*. Plate X. fig. 1.

Hab.: Seascale (*A. S. P.*). Height about 2 in.

Stem simple or sparingly branched on one side. Ramuli alternate, and much branched towards the extremity of the stem, these secondary branchlets



being again branched, so as to give the shoot a plumose appearance.

Calycles cup-shaped with serrated margins, three teeth on each side, two much everted. Mesial sarcotheca freer than in *A. pluma*, and quite prominent. Lateral sarcothecæ prominent and tubular. Gonophores borne in corbulæ with spur-like processes, as in *A. tubulifera*.

The zoophyte springs from a creeping stolon. A large number (from 15—20) of stems arise from a single stolon.

#### GENUS IV. LYTOCARPUS, *Kirchenpauer*.

*Stem* doubly or simply pinnate. *Calycles* with serrated or undulated margin, and with the mesial nematophore opening externally by one or two orifices. *Gonophores* protected by detached, over-arching processes, which never form corbulæ.—*Allman*.

There is only one British species of this genus, the distinguishing characteristic of which is the protective case for the gonophores, which consist of "cylindrical or spine-like appendages, which over-arch, but are never united so as to form a closed chamber."

##### 1. *L. MYRIOPHYLLUM*, *Linn.*

*Sertularia myriophyllum* (*Linn.*, *Pall.*, *Esper.*, *E.* and *S.*, *Berk.*, *Stew.*, *Bosc*), *Plumularia myriophyllum* (*Temp.*, *G. J.*, *D. L.*, *R. Q. C.*, *P. H. G.*, *McA.*, *De B.*), *Pennaria myriophyllum* (*Oken*), *Aglaophenia myriophyllum* (*Lamæ.*, *Ag.*, *T. H.*).

*Hab.*: Rare. Lamlash Bay (*D. L.*), Torbay (*T. H.*), Dartmouth (*Busk*), Aberdeen (*Macgillivray*), Dublin (*Ellis*), Isle of Man (*Forbes*). Height 6—12 in.

"This very rare coralline grows to the height of 10

or 12 inches. The root or first beginning consists of an irregular tuft of extremely small tubes, appearing like a piece of sponge to the naked eye. Several of these little tubes, rising together and united in close contact, become a stalk, which appears in the microscope curiously channelled and indented."—*Ellis*.

This is the "Pheasant-tail Coralline;" and an interesting incident is related respecting this species by Dr. Landsborough (Popular History).

Dr. Johnston, in the first edition of his "British Zoophytes," remarked that the vesicles of this species were a desideratum. Dr. Landsborough sent him a specimen having the vesicles upon it, which, he informs us, "was got by a fisherman, adhering to his long lines, off Whiting Bay, Arran, who, being struck with its beauty, like a kind-hearted man, took it home as a present to his wife; and she, being a person of similar taste, admired it as much as her husband had done. With all due care, therefore, she planted it in an old teapot filled with earth, and, watering it with fresh water every morning, she had the satisfaction of thinking that it grew a little larger under her judicious management! What would have been her delight had she foreseen that her sea-born, earth-nourished favourite was to flourish for ages in Dr. Johnston's well-known History!"

Very recently I was told by a Filey fisherman, who observed me taking a specimen of *A. ramosa* out of the dredge, that he "had had one of that kind, which stuck to his lines, growing in a plant pot out of doors, and that it had stood the winter very well"!

The pinnæ of this species appear to be given off on one side. This arises from the fact that, although the



pinnæ are alternate, they are given off "so nearly in a single line as generally to fold together."

SUB-DIVISION: *STATOPLEA GYMNOCARPA*.

GENUS V. *HALICORNARIA*, Busk.

Like *Aglaophenia*, but *without corbulæ or other protective case* for the gonophores.

This genus, originally proposed by Mr. Busk with a somewhat different diagnosis, was established by Prof. Allman (Hydroida of the *Porcupine*, Zool. Soc. Trans., 1874) for those zoophytes, otherwise resembling *Aglaophenia*, which have no protective corbulæ or cases.

1. *H. PENNATULA*, E. and S.

*Sertularia pennatula* (E. and S., Bosc, Flem.), *Plumularia pennatula* (Lamk., Flem., G. J., R. Q. C., D. L., P. H. G., McA.), *Aglaophenia pennatula* (Lamx., Ag., T. H.).

Hab.: Very rare. On the South Coast. Height 3—6 in.

This is the "Sea-pen or Feather Coralline" of E. and S., in whose notes it is described as being "as remarkable for the elegance of its form as for its likeness to the feather of a pen." In this species, which is very rare, the pinnæ are alternate and very close together, so as often almost to overlap. The calyces are crowded together on the upper side of the pinnæ, and each of them is denticulated at the sides and protected by a spinous process, which rises to some distance over the orifice and then bends over it. These spines vary in curvature. In one of my specimens the spines on the pinnæ on one side of the stem are all almost

straight, and on the pinnæ on the other side they curve considerably over the calyces.

The gonothecæ are not developed into corbulæ, but are somewhat pyriform in shape.

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### SUB-ORDER III. GYMNOCHROA.

(ELEUTHEROBLASTEA, *Allman.*)

#### FAMILY I. HYDRIDÆ.

GENUS HYDRA, *Linnaeus.*

*Polypites* locomotive, single, destitute of polypary, cylindrical or subcylindrical, with a single series of filiform tentacles round the mouth and a discoid adhesive base. *Gonozooids* always fixed, developed in the body walls.—T. H.

The structure of the members of this genus has been already fully described in the descriptive chapter. The different species are all inhabitants of fresh water.

The ease with which specimens of *Hydræ* can be secured makes them objects of constant interest and experiment. The most popular experiments are those conducted with a view to test their vitality. From the times of Baker and Trembley to the present, observers have been at work trying to what extent this much-suffering animal would bear mutilation.

Baker, in the tenth chapter of his work on "The Polyp," gives a course of experiments, amongst which are the following, which show an advancing scale of destructiveness and torture contrived with singular

ingenuity. 1. Cutting off a polyp's head. 2. Cutting a polyp in *two* pieces. 3. Cutting a polyp in *three* pieces. 4. Cutting the *head* of a polyp in *four* pieces. 5. Cutting a young polyp in two pieces whilst still hanging to its parent. 6. Slitting a polyp open and cutting off the end of its tail. 7. Cutting a polyp with four young ones hanging on it. 8. Quartering a polyp. 9. Turning a polyp inside out. 10. An attempt to make the divided parts of different polyps unite. 11. A young polyp becoming its parent's head. This is a course of torture sufficient to satisfy the most determined vivisectionist. Baker, not satisfied with suggesting the course, has elaborately described and figured the different stages of the experiments.

Mr. Dunkerley, of Manchester, has recently succeeded in most of these experiments, including the ninth. He informs us ("Microscopical News," October, 1883) that the hydra will sometimes turn itself inside out of its own accord, and that he himself has effected this result. Whether the hydra reversed the process afterwards, we are not told; but this is highly probable, as a continual reversement would imply an exchange of functions of the ectoderm and endoderm cells.

The hydra was discovered by Leeuwenhoek in 1703, and an anonymous Englishman communicated a similar discovery to the Royal Society about the same time. It was not much noticed, however, till Trembley's experiments, after which hydræ were imported by scientific men as valuable curiosities. They were re-discovered in England in 1743 by a Mr. Ducane, of Essex. The important results consequent upon the investigations undertaken at this time, have been noticed in the introduction.

1. *H. VIRIDIS*, *Linnæus*. Plate IX. fig. 7.

Polypes verds (*Trembley*), *Hydra viridissima* (*Pal.*).

Hab.: Common.

This species is distinguished by its grass-green colour (produced by chlorophyll), and by possessing 6—10 tentacles shorter than the body.

2. *H. VULGARIS*, *Pallas*.

*H. Grisea* (*Linn.*), *H. Brunnea* (*Templeton*).

Hab.: Common.

This species is of an orange-brown colour, with 7—12 tentacles, which are rather longer than the body.

3. *H. FUSCA* or *OLIGÆTIS*, *Pallas*.

*H. verucosa* (*Temp.*).

Hab.: Still waters, rather rare.

This species is of a brownish colour, and is noticeable by having the lower part of the body attenuated, and by possessing the power of extending the tentacles to an enormous length. Ellis called it the "Long-armed Fresh-water Polyp."

4. *H. ATTENUATA*, *Pallas*.

*H. pallens* (*Turt.*).

This species is probably a variety of *H. vulgaris*.

**ACTINOZOA (ANTHOZOA).****I. ZOANTHARIA.***Description.*

The Zoantharia or sea-anemones are animals very different in appearance from those already noticed, being all visible to the naked eye, and sometimes attaining a considerable size. They are often exceedingly beautiful in colour; and an observer, seeing them with fully extended disc and tentacles, has difficulty in persuading himself that he is not looking at some highly variegated specimens of the floral world. But flower-like as they are, their structure and habits are essentially animal. They differ from the hydrozoa in the facts, that the mouth does not open directly into the body cavity, and that the reproductive elements are borne along the margins of septa which divide the body cavity into compartments or chambers.

A sea-anemone (see Plate XI. figs. 1, 2) may be described as an animal having a body of a more or less columnar shape, terminated at the lower extremity by the base or pedal disc and at the upper extremity by the oral disc (*di*). The pedal disc is sometimes scarcely defined, the columnar body gradually tapering at the base; but the oral disc is always distinct. The oral disc bears the tentacles (*t*), which are extensions of the body wall, and communicate directly with the body cavity. In the centre of the oral disc is the mouth (*m*) opening into the œsophagus (*æs*), which is grooved, and hangs from the sides of the mouth

like a bottomless sac. This œsophagus extends only part way between the oral and pedal discs, and communicates at the bottom called the "gastric orifice," or "cardia," with the general body cavity. The general body cavity is divided into compartments by septa, which are lamellæ or plates, springing from the body wall and extending towards the œsophagus. Some of these septa reach to the œsophagus, to which they are attached. These are called primary septa. Between these are others reaching not quite to the œsophagus; these are called secondary septa. Between these, again, are tertiary septa, and so on, each succeeding group of septa being smaller than the preceding one; so that the body of an anemone being divided into six parts or systems by six primary septa, the succession of septa in any one system would be shown as follows—

1   3   2   3   1

the primary septa reaching to the œsophagus, and the rest, according to their grade, becoming shorter and shorter.

This appearance is shown in Plate XI. fig. 3. Deviations from this mode of arrangement, as in the *Cerianthidæ*, will be noticed where they occur.

The septa, whether primary or otherwise, bend towards the column from a point near the lower termination of the œsophagus, leaving the body cavity almost open from below that point.

The septa, or, as they are sometimes called, "mesenteries," are very important parts of structure, as they bear the reproductive organs, the craspeda (*cr*) or mesenteric filaments, and, where present, the acontia (*ac*).

Such being the general appearance of the sea-



anemones, the different points of structure may be more fully dealt with.

The structure of the body wall and septa reveals the presence of a threefold layer of cells, forming respectively the ectoderm (*ec*), mesoderm (*mes*), and endoderm (*en*). (See Plate XI. fig. 4.) The mesoderm may be taken as the groundwork of the structure, and extends throughout the body wall, œsophagus, and septa. The ectoderm extends along the outside of the body wall and the inside of the œsophagus. The endoderm covers the whole interior of the body wall and tentacles, and lines the septa on both sides.

The ectoderm, according to the most recent observers, Heider and Hertwig, contains three principal layers of cells—epithelial, nervous (*n*), and muscular (*m*). The epithelial cells are found to possess well-defined characteristics, and to be capable of subdivision into four layers—ciliated, stinging, glandular, and sensory. The ciliated cells bear a bunch of cilia or a simple flagellum, the latter form, however, occurring oftener in the epithelial cells of the endoderm. The form of the cilia is liable to modification, those on the tentacles being modified so as probably to serve tactile purposes. The stinging or urticating cells, or nematocysts (*c*), contain the stinging threads. The glandular (*d*) cells contain glandular secretions. The sensory cells are fine and filamentous, and give off nerve threads. All the epithelial cells, except the glandular ones, give off processes, either in the form of cilia or tactile bristles. The stinging and sensory cells are most numerous in the epithelium of the oral disc and tentacles, the ciliated and glandular cells increasing on the column and base. The nervous layer (*n*) of the ectoderm is found at the

base of the epithelial cells, and consists of nerve fibres and ganglion cells, the latter giving off fibrillæ from the different angles. The muscular layer (*m*) consists of flat, spindle-shaped, muscular fibrillæ, generally attached to epithelial cells, which are accordingly called epithelio-muscular. These muscular fibrillæ are strengthened by repeated pleatings. The muscular layer often extends into the mesoderm. The pigment granules, to which the colours of the anemones are due, lie in masses below the epithelial layer.

The mesoderm (*mes*) consists of layers of fibrillæ often closely interwoven. The mesoderm is thickest in the body wall and septa, and thinnest in the tentacles. There are also often found connective tissue cells scattered amongst the fibrillæ.

The endoderm consists of a muscular layer and a layer of cylindrical epithelial cells, each armed with a single flagellum. Nerve cells are found sparsely distributed.

The muscles of the column or body wall are almost always highly developed just below the oral disc, where they form a muscle or sphincter, which sometimes enables the disc to be drawn below the upper portion of the column, and so covers the tentacles. The power to retract the tentacles depends on the presence of a weak or strong sphincter. Some observers assert the presence of a special sphincter to close the cardia of the œsophagus; but others, including the brothers Hertwig, deny this. The muscles of the septa take different directions, those on one side being transverse, those on the other longitudinal.

The base or pedal disc is generally imperforate. In some species, where the pedal disc is wanting, there is an anal pore as in *Cerianthus*. Occasionally the



pedal disc is furrowed, the furrows having a distinct relation to the arrangement of the septa.

The tentacles are hollow and are prolongations of the body cavity. Their number bears a distinct relation to the interseptal and intraseptal chambers (i.e. the segments into which the body cavity is divided by the principal and secondary septa). They are perforated at the tip, and can be opened and closed at the will of the animal, being supplied near the orifice with a sphincter muscle. Many species are able to extend individual tentacles to a considerable distance.

The mouth is a simple longitudinal opening in the centre of the oral disc, and forms the entrance to the œsophagus. There are two lip-like folds, one on each side of the mouth. The shape of the mouth enables the body to be described with reference to it, two axes being clearly defined, the sagittal axis running in the direction of the mouth and the transverse axis at right angles to it. The œsophagus (*œs*) or, as some observers have called it, the stomach, is marked with furrows or grooves running from top to bottom, those which proceed from the angles of the mouth being larger and deeper, and generally passing near the gastric orifice into lappets which hang down from the base of the œsophagus. These larger grooves are always open and richly ciliated, and are called "gonidial grooves." Some observers have detected coloured masses in the walls of the œsophagus, which they suspect to have a biliary action.

The septa, as before described, divide the body cavity into distinct segments. The usual arrangement amongst the Zoantharia is hexameral (i.e. that there are six primary septa). In most cases also there are

six secondary and twelve tertiary septa. After the tertiary septa have been formed, only two of each succeeding group appear in each sextant, so that the arrangement of a sextant containing septa up to the fifth order would be as follows—

1 4 3 5 2 5 3 4 1

The septa are often perforated by foramina or stomata, which serve to promote the circulation of fluid along the chambers of the body cavity.

The craspeda or mesenteric filaments (*cr*) lie upon the edges of the septa and are formed by the supporting lamella splitting into two parts which enclose the ovary, and then uniting in the form of a cylindrical cord like "the hem of a flounced garment." The craspeda consist of a middle portion containing large numbers of urticating cells and two lateral laminae of ciliated cells. The use of the craspeda is somewhat uncertain, some observers regarding them as oviducts.

The acontia (*ac*) are extremely interesting portions of structure. They are present in all the *Sagartidæ*, and have the appearance of long, thread-like filaments or cords, capable of being ejected through the mouth or body wall to a considerable distance and then retracted. They lie coiled at the lower end of the septa. Many species eject these acontia in large numbers on the least provocation. If a small portion be cut off and examined under a high power of the microscope, an extraordinary structure is manifest. The whole acontium is seen to be a ribbon with a band of connective tissue, nerves, and muscular fibres, and an immense number of large thread cells. This ribbon possesses great powers of movement, and portions may be seen,

after being cut off, to coil and uncoil themselves whilst under examination. The acontium is ciliated all over, and is either kidney-shaped in transverse section (*Hertwig*) or flat, but capable of bringing its edges together so as to form a tube (*Gosse*).

The acontia are often emitted through the body wall of the column, which, in many species, is provided with special loopholes for the purpose. These loopholes were first discovered by Mr. Gosse, who gave to them the name of *cinclides*. (See Plate XI. fig. 6.) They occur in the Sagartidæ, and are described by Mr. Gosse as presenting an appearance such as would be presented by the lids of the human eye, supposing them to be reversed. The *cinclides* appear to be covered by a thin membranous film, either of mucus or epithelium. An interesting description of the *cinclides* and the acontia is contained in Mr. Gosse's "Hours with the Microscope."

The thread cells with which the acontia are crowded are remarkable structures. Three forms have been observed and described by Mr. Gosse.

1. Chambered cnidæ, which are lengthened, egg-shaped cells, containing a fusiform chamber opening out at the broader end and continued at the other end into a long cord or thread (the *ecthoreum*), which fills up the cell and is often many times longer than the cnida. The *ecthorea* are generally armed with spiral bands or screws (*strebla*), to which are attached barbs or bristles (*pterygia*). (See Plate XI. fig. 5 b, c.)

2. Tangled cnidæ, in which the figure of the cnida is almost oval. The cavity contains a very long *ecthoreum*, which is coiled up often in a loose and irregular manner.

3. Spiral cnidæ, in which the *ecthoreum* is a long, cylindrical thread, coiled into a close and regular spiral. (See Plate XI. fig. 5 a.)

The threads are tubular, and are believed to be ejected from the cnidæ by the expansion under irritation of the fluid contained in the cnidæ, which expels the threads with very considerable force. How the threads act so as to inflict fatal wounds upon the minute organisms into which they enter is not properly known. Mr. Gosse considers that the ecthorea are filled with some poisonous fluid which pours out through openings in the barbs, and enters the tissues of the animal attacked, the everted form of the barbs preventing the withdrawal of the ecthoreum when once inserted.

The British anemones belonging to the sub-order *Sclerodermata* deposit a *corallum* or internal calcareous skeleton. The parts of the corallum are the *base* and *wall*, the latter sometimes ribbed, the *plates* formed in the septa, the *palules*, which are arranged in a circle or circles between the septal plates and the centre, and the *columella*, which is a series of twisted plates at the bottom of the cavity. The plates, like the septa, are arranged in cycles. The hollow centre of the coral above the plates is called the *calyx*.

There are three modes of reproduction amongst the anemones—fission, gemmation, and sexual generation. Fission occurs either by longitudinal splitting or by the chipping off, as it were, of parts of the base, each part becoming a complete animal.

Gemmation principally occurs in those genera which possess a corallum or stony skeleton. It, however, occurs in other genera very largely, the buds appearing sometimes on the disc and at others on the base.



In sexual reproduction the ovum, after being fertilized, passes through the usual stages of segmentation. The young are discharged through the mouth of the parent, and may be so discharged in any stage either as ova, or, after fertilization, as *morulae*, or, in case the entire development has been carried on in the mesenteric chambers, as fully formed young, differing from their parent only in size.

The anemones live occasionally to a great age, one being named by Dr. Wilson ("Science for All," vol. iv. p. 156) as in the Royal Botanic Gardens, Edinburgh, which was first obtained by Sir John Dalrymple from the Firth of Forth in the year 1828.

The development of the anemones was first fully described by Dr. Cobbold in the "Annals of Natural History" for February, 1853. The most recent work in English dealing with the anatomy of the Malacodermata, is the contribution by Prof. Hertwig to the *Challenger* Reports. This contains a summary in English of the book published in Germany, in 1879, by the brothers Professors O. and R. Hertwig, "Die Actinien." The most recent English work dealing with the Sclerodermata is the contribution to the *Challenger* Reports of Mr. Moseley, and a revision of the classification of the same sub-order by Prof. Martin Duncan, published in vol. xviii. of the Journal of the Linnean Society. The "Actinologia Britannica" of the Rev. P. H. Gosse, referred to on page 14, still remains the only book in English dealing with the whole of the British Zoantharia. Recently, however, Dr. Andres has published in Italian a contribution dealing with the Malacodermata, in which all the British species of that sub-order are described. His treatise forms Part

ix. of the series issued under the direction of the Naples Zoological Station, upon the Fauna and Flora of the Gulf of Naples.

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### CLASSIFICATION OF THE ZOANTHARIA.

As just stated above, the only work in English dealing with the whole of the British Zoantharia is the "Actinologia Britannica" of the ~~P.~~ P. H. Gosse. I have followed, so far as possible, the classifications adopted by him, bringing them, however, into conformity with the more recent systems of Prof. Hertwig and Dr. Andres. The classification adopted by the latter is very much in accordance with that of Mr. Gosse; and as it is based chiefly upon easily observable characters, I have preferred it to that of Prof. Hertwig, noticing, however, any prominent differences in the systems.

The Zoantharia are divided by Milne Edwards into three sub-orders, viz.: the MALACODERMATA (*Actiniaria* of Hertwig and Andres, and *Astræacea* of Gosse); SCLEROBASICA, of which there is no British species; and SCLERODERMATA (*Caryophyllacea* of Gosse and *Madreporaria* of Moseley and Duncan).

The British species of the MALACODERMATA possess no corallum, and, with the exception of the *Zoanthinæ*, are never found in colonies.

The SCLERODERMATA deposit a corallum.

The British MALACODERMATA are divided into five families, namely, the *Actininæ*, *Edwardsinæ*, *Cerianthinæ*, *Stichodactylinæ*, and *Zoanthinæ*.

The *Actininæ* include the sub-families *Sagartidæ*, *Phellidæ*, *Actinidæ*, *Bunodidæ*, *Ilyanthidæ*, *Siphonactinidæ*, and *Halcampidæ*. The family *Edwardsinæ* contains the sub-family *Edwardsidæ*; the *Cerianthinæ*, the sub-family *Cerianthidæ*; the *Stichodactylinæ*, the sub-families *Corynactidæ* and *Aurelianidæ*; and the *Zoanthinæ*, the sub-family *Zoanthidæ*.

The British *SCLERODERMATA* are divided into two sections, *Aporosa* and *Perforata*. The former includes the families *Turbinolidæ*, *Oculinidæ*, and *Astræidæ*. The latter includes the family *Eupsammidæ*.

## BRITISH ZOANTHARIA.

SUB-ORDER: **MALACODERMATA** (ACTINIARIA).

## FAMILY I. ACTININÆ (HEXACTINILÆ).

*Malacodermata with never less than twelve septa, and having the tentacles disposed in cycles, corresponding with the internal divisions.*

## SUB-FAMILY I. SAGARTIDÆ.

*Species possessing acontia, and having a strong mesodermal circular muscle and numerous simple very contractile tentacles. Body wall smooth. Septa more than twelve in number. Principal septa only perfect, also sterile, all the remaining septa being imperfect.*

GENUS I. ACTINOLOBA, *De Blainville*. (*Actinia*, and *λοβός*, a lobe.)

*Body pillar-like when extended. Body wall smooth, pierced with loopholes. Disc deeply frilled at the margin. Tentacles short, slender, not arranged in distinguishable circles, scattered at the commencement, about half-breadth of the disc becoming gradually smaller, more numerous, and densely crowded as they approach the border. Mouth with a single gonidial groove, surmounted by a single pair of tubercles.—*  
GOSSE.



1. *A. DIANTHUS*, *Ellis*. "The Plumose Anemone." Plate XII. fig. 1.

*Actinia dianthus* (*Ellis, E. and S., G. J., Dal., P. H. G., D. L., R. Q. C., Ald., Tugwell*), *A. senilis* (*Linn., Lamk.*), *A. Judaica* (*Linn., Lamk.*), *A. plumosa* (*Müll., De Bl., Stew., Lamk., G. J.*), *A. pentapetala* (*Pennant*), *Sagartia dianthus* (*P. H. G.*), *Actinia aurantiaca* (*Jordan*).

Hab.: Very generally distributed on rocks, &c., in deep water, and between tide-marks. Southport, Puffin Island (*A. S. P.*). Height to 6 in. when fully extended.

Colours, brown, red, yellow, white.

This is the only British species of this genus, and its specific characters may be gathered from the generic ones. It is the most beautiful of all the anemones, and when fully expanded in a column 5 or 6 in. high and 2 or 3 broad, surmounted by a parapet which encircles the body like a moulding, and terminating in a disc divided into lobes, and perfectly fringed with tentacles, of a pure white, or fawn, or cream, or orange, or pink colour, as the variety may be, it forms an object of conspicuous interest and beauty. No one who has once seen it so expanded, can ever forget it; and as it is always a prominent object in public aquaria, no one need want an opportunity of seeing it. Its colour varies as stated, and is generally pure, but whatever shade the disc and body take, the lips are nearly always orange-red. Mr. Gosse classifies the varieties according to colours. (a) *Brunnea*, applied to those of the various shades of brown; (b) *Rubida*, those of any tint of red; (c) *flava*, yellow, rare; (d) *Sindonea*, pure white. *A. dianthus* is a very hardy species, and may be kept in confinement for a long time. Mr. McIntosh (*St. Andrew's Fauna*)

states that when very hungry it will eat seaweed. It has been stated by many observers that when once fixed it will not bear removal without injury; but this is undoubtedly incorrect. I have transferred specimens from one stone to another, and from one tank to another, without injury. The specific name *Dianthus* was given to it by Ellis from its resemblance to the carnation or pink. Couch calls it the "Sea Carnation." This species forms a very good object for study, as, in order to attain its full distension, it has to take in a great quantity of water, and when distended the internal structure may be easily made out.

GENUS II. HELIACTIS, *Thompson*. (Ἡλιός, the sun, and ἀκτῖν, a ray.)

*Body* changeable. *Body wall* smooth, furnished at the upper portion with large warts or suckers. *Disc* concave. *Tentacles* numerous, and arranged in several rows. *Mouth* various, with two gonidial grooves. *Lips* finely furrowed. *Acontia* emitted freely.

1. H. BELLIS, *E. and S.* "The Daisy Anemone." Plate XII. fig. 2.

*Actinia bellis* (*E. and S.*, *Turt.*, *G. J.*, *D. L.*, *R. Q. C.*, *P. H. G.*), *A. pedunculata* (*Pennant*), *A. Templetonii* (*Cocks*, *R. Q. C.*), *Actinocercus pedunculata* (*De Bl.*, *Flem.*, *Temp.*), *Cribrina bellis* (*Ehr.*), *Hydra bellis* (*Stew.*), *Sagartia bellis* (*P. H. G.*).

*Hab.*: South and West Coasts; Menai Straits (*A. S. P.*). Height 1—3 in., with breadth of disc  $1\frac{1}{2}$ —2 in.

*Colour.* (a) *Tyriensis*: Column flesh-colour, passing through pink, white, drab, or buff, to dull violet. Disc dark brown or black with radiating lines of vermillion.

Tentacles yellowish-brown. (b) *Versicolor*: Disc yellowish-grey. Tentacular border pale blue and dull black. Column rose-pink and purple-grey. (c) *Eburnia*: Disc ivory-white. (d) *Modesta*: Disc deep amber-brown. (e) *Sordida*: Column dull yellow. Disc blackish-brown, with grey and white spots.

In the Daisy Anemone "the disc is formed like a star, which, according to the figure that is traced out by the innermost row of the tentacles, consists of many angles. The colour of this part is a beautiful mixture of brown, yellow, ash-colour, and white; which, together, form variegated rays which, from the centre or mouth of the animal, are spread over the whole surface of the disc."—*Gärtner*.

This species is generally found between tide-marks. It may be easily kept in confinement, and is very prolific, as many as 150 to 300 young having been observed to be discharged in a single day. It is very mutable in shape, being able to constrict the column at any part. The acontia are very readily discharged on irritation. The tentacles number about 600.

2. *H. MINIATA*, *Gosse*. "The Scarlet Fringed Anemone."

*Actinia miniata* (*P. H. G.*), *A. ornata* (*T. S. W.*), *Bunodes* (?) *miniata* (*P. H. G.*), *A. elegans* (*Dal.*), *Sargatia miniata* (*P. H. G.*).

Hab.: South and West Coasts; Menai Straits (*A. S. P.*). Height to 2 in.

Colour. (a) *Ornata*: Column deep brown deepening to purplish. Disc yellowish or grey. Tentacles yellowish, outer row with a scarlet cone. Mouth orange-red. (b) *Venustoides*: Disc rich orange. Tentacles whitish with two black bars. (c) *Roseoides*: orange-brown,

with pale yellowish-grey disc and rose-coloured tentacles. (d) *Niveoides*: Drab-olive, with opaque white tentacles. (e) *Coccinea*: Deep crimson, with crimson tentacles. (f) *Brunnea*: Umber, with long umber-coloured tentacles.

The distinguishing features of this species are the outer scarlet row of tentacles, and the two longitudinal dark lines on the front of all the tentacles, with a white space at the bottom of each, crossed by a broad black bar. The column has a number of large suckers on the distal half, and the disc is marked with radial striæ. This species can be well kept in captivity. It readily emits acontia, which contain both chambered and unchambered cnidæ. The cnidæ are very easily made out with  $\frac{1}{8}$ -inch lens, as well as the contained ecthorea, which are either short and furnished with rows of barbs spirally arranged, or are very long and terminate in a point.

3. *H. VENUSTA*, Gosse. Plate XII. fig. 3.

*Actinia rosea* (P. H. G.), *A. pulcherrima* (Jordan), *A. vinosa* (Holdsworth), *Sagartia rosea* (P. H. G.), *Actinia venusta*, *Sagartia venusta*, *Sagartia aurora* (P. H. G.), *Actinia aurora* (Tugwell), *Actinea nivea*, *Sagartia nivea* (P. H. G.).

Hab.: Guernsey, Torquay, Tenby (P. H. G.), Clovelly (Kingsley), Menai Straits (A. S. P.). Height to  $1\frac{1}{2}$  in., diam. to 1 in.

Dr. Andres unites under one specific name the three species of Gosse, *S. venusta* ("the Orange Disc Anemone"), *S. nivea* ("the Snowy Anemone"), and *S. rosea* ("the Rosy Anemone"). The first of these, which he calls the type, (a) *typus*, is brown, with brilliant orange disc and pure white tentacles. The

purple ribbon encircling the tentacle foot" is the distinguishing feature of the species, and suggests the specific name.

3. *S. PALLIDA*, *Holdsworth*. "The Pallid Anemone."

*Actinia pallida* (*Holdsw.*).

Hab.: Dartmouth. Height  $\frac{2}{3}$  in., diam.  $\frac{1}{3}$  in.

Colour. (a) *Cana*: Pellucid white. Tentacles almost embraced by two curved lines of light blue. (b) *Rufa*: Column brownish-orange.

The tentacles are numerous, long and slender, and arranged in four rows. The encircling blue lines distinguish this species.

4. *S. PURA*, *Alder*. "The Translucent Anemone."

*Actinia pellucida* (*Ald.*), *S. pellucida* (*P. H. G.*).

Hab.: Rare. Northumberland Coast. Height  $\frac{1}{4}$  in., diam. of column  $\frac{1}{6}$  in., of disc  $\frac{1}{2}$  in.

Colour. Pellucid white without markings.

Tentacles, 30 in three rows.

Described by Alder in "Cat. of Zoophytes of North: and Durham," page 43.

5. *S. CHRYSOSPENIUM*, *Cocks*. "The Gold-spangled Anemone."

*Actinia chrysosplenium* (*Cocks, G. J., D. L.*).

Hab.: St. Ives (*Cocks*). Rare. Height 1 in.

Colour. Pea-green to dark holly-green, banded with spots of golden-yellow, with a golden line round the base. Disc yellowish-white. Tentacles whitish, crossed by green bars.

This species is regarded by Dr. Andres as an abnormal form of uncertain position.

GENUS IV. *CYLISTA*, *Gosse*. (*κυλιώ*, to wallow about.)

Column changeable, smooth below, with numerous

distinct small suckers on the upper half. *Disc* narrow. *Tentacles* numerous, long and tapering.

1. *C. COCCINEA*, Müller. "The Eyed Anemone."

*Actinia coccinea* (Müll., G. J., D. L.), *Sagartia coccinea* (P. H. G.).

Hab.: Coast of Ireland (*Forbes*), Caithness and Cornwall (*O. W. P.*). Height  $\frac{1}{2}$  in., diam.  $\frac{1}{2}$  in.

Colour. Rufous with white lines. *Disc* light red with radii of two white lines each. *Tentacles* pellucid, ringed with white, with a broad dark brown bar between the two lower rings, and two black spots below.

The number of tentacles is about 64. They are short and conical.

2. *C. UNDATA*, Müller. "The Cave-dwelling Anemone."

*A. troglodytes* (G. J., D. L., *Cocks*, *Tugwell*, *Van Beneden*, *Ald.*), *Scolanthus sphæroides* (*Holdsworth*), *Actinia undata* (Müll.), *Sagartia troglodytes* (P. H. G.).

Hab.: Very generally distributed. Height 1—2½ in., diam. 1—2 in.

Colour. Very variable. Greenish-drab, grey, buff, orange, white, and violet-blue.

Mr. Gosse describes twenty varieties of this species, which is known to English naturalists by the name *Troglodytes*. The tentacles are "barred transversely and marked at the foot with a black character resembling the Roman letter B." They number as many as 200, and are arranged in four or five rows, of which those in the outer row are the largest. The column contains a large number of suckers at the distal end. This species generally chooses a hole in a wall as its habitation. "It occupies a hole fitted to the size of its body in our shelving soft slaty rocks, where, when covered with



water, it expands into a wide circle, its oval disc and tentacula raising themselves scarcely above the level of its habitation." It appears, however, that both in the sea and in captivity it often exists in a free state without permanently attaching itself.

3. *C. VIDUATA*, Müller. "The Snake-locked Anemone." Plate XIII. fig. 2.

*Actinia viduata* (Müll., G. J., Lamk., R. Q. C., D. L.), *A. anguicomma* (Price, D. L., G. J., P. H. G.), *Isacmæa viduata* (Ehr.), *Sagartia anguicomma* (Kingsley), *S. viduata* (P. H. G.).

Hab.: Guernsey, Torquay, Ilfracombe, Tenby (P. H. G.), Menai Straits (A. S. P.). Height 1—2 in., diam. of disc  $1\frac{1}{2}$  in.

Colour. Light buff marked with longitudinal bands of lighter colour. Disc whitish-grey, covered with a mealy or speckled pattern. Tentacles grey, with a line of dark brown down each side. A variety, *melanops*, has "a broad, well-defined band of deep black crossing the disc and tentacles."

There are about 200 long, slender, flexible tentacles arranged in five rows. The name "snake-locked" is very appropriate, as the tentacles are waved carelessly about in all directions, in "irregular snaky curves, the anemone reminding one of a cylindrical monumental figure, surmounted by an abundant collection of serpents."

#### GENUS V. *ADAMSIA*, Forbes.

Named in honour of Mr. John Adams.

*Base* adhering forcibly, and secreting a membrane. *Column* elevated or depressed. *Body wall* smooth, pierced with loopholes forming permanent warts.

*Tentacles* imperfectly retractile. *Mouth* protrusile, thrown into loose folds not furrowed. *Acontia* emitted freely.

1. *A. PALLIATA*, *Adams*. "The Cloak Anemone."

*Medusa palliata* (*Bohadsch*), *Actinia maculata* (*Adams*, *Coldstream*, *G. J.*, *Pennant*), *A. cariniopados* (*Otto*), *A. picta* (*Risso*), *A. maculata* (*Forbes*).

*Hab.*: Wick (*C. W. P.*), Weymouth, Torbay, Falmouth (*P. H. G.*), Arran (*D. L.*), Isle of Man (*Forbes*).

*Colour*. Brown to white, spotted with purple, and disc pure white, bordered with pale scarlet. *Tentacles* white. *Acontia* lilac.

This species is generally found on a shell inhabited by a Hermit Crab, *Pagurus Prideauxii*. There would seem to be "a treaty of union" between the Cloak Anemone and the Pagurus. In case the shell to which the *Adamsia* attaches itself happens to be imperfect, it has the power of secreting a chitinous membrane which serves for its support, and this membrane often extends beyond the outer whorl of the shell.

Dr. Landsborough, in alluding to the association between the crab and the anemone, says: "In all likelihood they in various ways help each other. The Hermit has strong claws, and while he is feasting on the prey he has caught, many spare crumbs may fall to the share of his gentle-looking companion. But soft and gentle-looking though the anemone be, she has a hundred hands, and woe to the wandering wight who comes within the reach of one of them, for all the other hands are instantly brought to its aid, and the Hermit may soon find that he is more than compensated for the crumbs that fall from his own booty."



2. A. RONDELETH, *De Ch.* "The Parasitic Anemone." Plate XIII. fig. 1.

*Actinia effœta* (*Rapp.*), *A. parasitica* (*R. Q. C.*, *D. L.*, *G. J.*, *Cocks*, *P. H. G.*, *Tugwell*), *Sagartia parasitica* (*P. H. G.*), *Calliactis effœta* (*Andres*).

Hab.: On shells occupied by Hermit Crab. Guernsey, Weymouth, Torquay (*P. H. G.*), Penzance (*R. Q. C.*). Height to 4 in.

Colour. Dirty white or drab with longitudinal bands of brownish shades. Disc yellowish-white. Tentacles upwards of 500 in seven rows, flesh colour, marked with a dark purple or brown line, broken into about five dashes down each side. Skin coriaceous.

This anemone is generally parasitic on *Pagurus Bernhardus*. The advantage of an alliance of this kind has been pointed out by Herr Eisig, who has observed that the anemone is a very valuable protector of the *Pagurus* from the attacks of the *Octopus*, the latter instantly retreating on being touched by the stinging organs of the anemone.\*

The acontia are as thick as sewing-cotton, and can be sent out to the extent of 4—6 inches.

This species is known in English works as *S. parasitica*.

Mr. Gosse states that on handling specimens, a most offensive, "insufferably nauseous" odour is communicated to the fingers, which "even scrubbing with a brush scarcely avail to remove." It is, however, a favourite object in aquaria.

\* J. R. M. S., vol. iii. (N. S.), 493, August, 1883.

GENUS VI. GREGORIA, *Gosse*.

Named after Mr. Gregor, of Banff.

*Body wall* smooth, without suckers, with conspicuous loopholes arranged longitudinally. *Tentacles* short, blunt, not perfectly retractile. *Mouth* with two gonidial grooves, each with a pair of small tubercles. *Acontia* emitted sparsely.—GOSSE.

G. FENESTRATA, *Gosse*. "The Eyelet."

Hab.: Banff (*W. Gregor*). Height  $\frac{1}{8}$  in., diam.  $\frac{1}{8}$  in.

Column green with purple lines. *Tentacles* red, 48 in three rows.

This genus and species are very doubtful. They are established by Mr. Gosse from a single specimen, which Dr. Andres considers, both from its small size and delicate structure, was probably an immature form.

GENUS VII. AIPTASIA, *Gosse*. (ἀἰ, always, πτεράω, to expand.)

*Body* trumpet-shaped. *Body wall* corrugated, pierced with cinclides. *Tentacles* in several rows, long, lax, perforate at top. *Acontia* abundant.—GOSSE.

1. A. COUCHII, *Forbes*. "The Trumpet." Plate XIII. fig. 3.

(?) *Actinia biserialis* (*Forbes, Cocks, G. J., D. L.*), *Anthea Couchii* (*Cocks*), *Aiptasia amacha* (*P. H. G.*), *Dysactis biserialis* (*Milne Edwards*).

Hab.: Guernsey (*Hilton*), Falmouth (*Hodges*), Herm (*Whitchurch*). Height 4 in., diam.  $\frac{1}{8}$ — $\frac{3}{4}$  in.

Colour. Orange-buff with faint lines. Disc iron-grey with pale greyish-blue radii. *Tentacles* sepia-brown.

This species is slender at the base, but enlarges towards the disc, which, being concave, gives the anemone a trumpet shape. The tentacles are in four rows, the innermost row being  $1\frac{1}{2}$  in. long and the outermost  $\frac{1}{2}$  in. They are sometimes forked. The cinclides appear to be very easily examined in this species. Mr. Gosse states that he has been able to thrust a fine needle into them without the animal being conscious of it.

Mr. Holdsworth relates an instance of a specimen of this species which he missed on one occasion from his aquarium, and having applied the stomach-pump, in the shape of a stick, down the throats of some specimens of *bellis*, he succeeded in dislodging it from one of them amongst a shapeless mass of membrane and *acontia*." Strange to say, this poor victim recovered from its Jonah-like adventure.

#### SUB-FAMILY II. PHELLIDÆ, *Andres*.

*Species possessing acontia and cinclides. Tentacles retractile, small, and few in number. Column partly clothed with a tough epidermis, which is rough externally and firmly adherent to the epithelium.*

Dr. Andres establishes the *Phellidæ* as a separate sub-family of the *Actininae*, on the ground of the possession by the species comprised in it of a cuticular sheath.

The sub-family contains (so far as British species are concerned) three genera—*Phellia*, *Octophellia*, and *Chitonactis*. The species included by Dr. Andres in the genera *Phellia* and *Octophellia* are all placed by Mr. Gosse, and also by Prof. Hertwig, in the former of these genera. The genus *Chitonactis* was established by Fischer (who is followed by Dr. Andres) for the

species *Bunodes coronata* of Gosse, which has a deciduous epidermis, and, therefore, properly belongs to the present sub-family.

GENUS I. *PHELLIA*, Gosse. (φελλὸς, the cork-tree.)

*Body wall* as above described. *Tentacles* small, in rows of twelve.

1. *P. MUROCINCTA*, Gosse. "The Walled Corklet."

*Hab.*: Torquay (*P. H. G.*). Height  $\frac{1}{8}$  in., diam. of column  $\frac{1}{8}$  in.

*Colour.* Epidermis dense. Column grey, speckled with white, and without warts. Disc buff, with white star. Tentacles dark brown, with three narrow white rings.

The epidermis is roughened by the addition of particles of foreign matters.

This species is very small, and Mr. Gosse tells us that it was discovered by his little son, who detected the tiny atom on one of the fragments of rock his father had brought home.

Though small it is very beautiful. The tentacles number 24, placed in two rows 12 in each; those of the first row being twice as large as the others.

2. *P. PICTA*, Gosse. "The Painted Corklet."

*Hab.*: Banff (*W. Gregor*). Height and diam.  $\frac{1}{8}$  in.

*Colour.* Epidermis transparent and colourless, and without warts. Column white. Disc light yellow crossed by radii of orange, and bounded by a brown circle. Tentacles white, with three opaque bands.

A small and very pretty species, probably allied to the preceding.

3. *P. BRODRICH*, Gosse. "The Latticed Corklet."

Hab.: Lundy Island (*W. Brodrick*). Height 1 in., diam.  $\frac{1}{2}$ —1 in.

Colour. Epidermis drab, dense. Column white. Disc drab, with chocolate-coloured radii. Tentacles white, "crossed by four transverse bars of dusky, the whole (except the lowest one) connected by three longitudinal lines of the same colour, which impart a latticed or window-like pattern to the tentacle."

The tentacles number 96 in five rows.

#### GENUS II. OCTOPHELLIA, *Andres*.

*Tentacles* in rows of eight.

1. *O. GAUSAPATA*, *Gosse*. "The Warted Corklet."

*Phellia gausapata* (*P. H. G.*).

Hab.: Wick Bay (*C. W. P.*). Height  $\frac{3}{4}$  in., diam.  $\frac{1}{2}$  in.

Colour. Epidermis pale yellow with darker warts, "resembling, when contracted, a straw beehive" (*C. W. P.*). Column white. Tentacles drab, 16 arranged in two rows.

This species was received by Mr. Gosse from Mr. Peach by post on the same day that he discovered the preceding species. He thinks it possible that the two may be identical.

#### GENUS III. CHITONACTIS, *Fischer*. (*χιτών*, a garment.)

*Phellidæ* with a distinct parapet. Column covered with warts arranged in series. Epidermis deciduous. *Tentacles* in rows of twelve.

This genus was founded by Fischer (who is followed by Dr. Andres) for *Bunodes coronata*, Gosse, which is clearly a member of the *Phellidæ* rather than of the *Bunodidæ*.

1. *C. CORONATA*, *Gosse*.

*Bunodes coronata* (P. H. G.).

Hab.: South Coast of Devon. Height 2 in.

Column, cylindrical in extension, covered on the upper two-thirds of its height with small warts in twelve longitudinal rows. The column is covered by a drab epidermis, which, however, is deciduous and not permanent, and the summit of the column is surmounted by a distinct parapet. The tentacles number 96.

Colour. (a) *Patricia*: Orange or orange-scarlet. Edge of parapet cream-white, marked below with alternate patches of dark chocolate and white. Disc red, with white radii. Tentacles pellucid, with white bars. (b) *Plebeia*: Column dirty light brown. Disc brown, with drab radii. Tentacles not barred.

### SUB-FAMILY III. ACTINIDÆ.

*Actininæ with moderately long and perforated tentacles, and without acontia.*

This sub-family is made by Dr. Andres to include not only *A. equina* (*mesembryanthemum*), which is the only species of the family assigned to it by Mr. Gosse, but also *A. sulcata* (*Anthea cereus*), which Mr. Gosse and Prof. Hertwig place amongst a family *Antheadæ*. This latter family is not, however, retained by Dr. Andres.

### GENUS I. ACTINIA, Linn.

Body wall smooth, separated from the disc by a well-developed margin. Tentacles as above. Marginal spherules present. No acontia.—GOSSE.

*A. EQUINA*, Linn. "The Beadlet." Plate XIV. fig. 1.

*A. rufa* (Penn., Müll., Lamk., Rapp), *A. corallina* (Risso), *A. margaritifera* (Temp., Cocks, G. J., D. L.),



*A. Forskali* (*M. Edw.*), *A. cerasum* (*Dalyell*), *A. chio-  
cocca* (*Cocks, G. J., D. L.*), ? *A. tabella* (*Dana*), *A.  
fragacea* (*Tugwell*), *Entacmæa mesembryanthemum* and  
*E. rufa* (*Ehr.*), *Actinia mesembryanthemum* (*E. and S.,  
G. J., R. Q. C., D. L., P. H. G., Tugwell, Cocks, Ald., &c.*).

Hab.: Universally distributed on rocks. Diam. of  
base 1—4 in. Height 1 in.

Colour. (a) *Hepatica*: Liver-brown, with crimson  
disc and tentacles, and blue basal line and spherules.  
(b) *Rubra*: Dark crimson with violet spherules. (c)  
*Chiococca*: Rich scarlet with crimson disc and tentacles,  
and pure white spherules. (d) *Umbrina*: Yellowish-  
brown all over. (e) *Ochracea*: Orange-buff. (f) *Oli-  
vacea*: Dark olive. (g) *Viridis*: Green. (h) *Opora*:  
Leek-green with broken lines of green or yellow.  
(i) *Tigrina*: Red streaked with yellow. (k) *Fragacea*  
(the *Strawberry*): Dark red with light green spots.  
All the varieties, except (b) and (c), have blue sphe-  
rules, and all, except (b) (c) (k), have the basal line also  
blue.

This species, commonly known as *mesembryanthe-  
mum*, is the most common of all the anemones, and  
has been dissected and described over and over again.  
A very plain account of its structure will be found in  
an article by Mr. F. A. Bedwell in the Journal of the  
Quecket Club, vol. v. (November, 1879), 213.

I shall not soon forget my introduction to this  
species. I found a number of the variety *olivacea*  
hanging in dense clusters, mouth downwards, on a  
rock in the Menai Straits, distended by the water they  
contained, "having much the appearance of ripe and  
unripe greengages." There were several of the above  
varieties in the neighbourhood.

The noticeable features of the Beadlet are the marginal spherules and basal line, about which much has been written. A summary of previous investigations, together with descriptions of the morphology of these parts, by Prof. P. Martin Duncan, is contained in the *Monthly Microscopical Journal*, vol. xii. (1874), p. 65. This article is illustrated by descriptive plates, showing fully the structure of the spherules and base. The spherules are held to be a primitive form of eye.

"The evolution of an eye which can distinguish outlines, shades, and colours probably took the path which is thus faintly indicated in the *Actinia*, which doubtless has an appreciation of the difference between light and darkness."

As to the diffused nervous tissue found in the base, probably "its function is to assist in the reflex movements of the animal, and to produce expansion of the disc on the stimulus of light."\* Professors Hertwig and Dr. Andres, on the contrary, consider the spherules as urticating batteries or nematophores.†

## GENUS II. ANEMONIA, *Risso*.

*Tentacles* long, not retractile. No *spherules*, *acontia*, *warts*, or *cinclides*.

### 1. *A. SULCATA*, *Pennant*. "The Opelet."

*Actinia viridis* (*De Bl., Lamk.*), *A. cereus* (*E. and S., Rapp, Grube*), *A. sulcata* (*Penn., Andres*), *Anemonia edulis* (*Risso*), *A. sulcata* (*M. Edw.*), *Anthea cereus* (*P. H. G., Hass., G. J., D. L., &c.*).

Hab.: Guernsey (*Holdsworth*), Plymouth, Ilfracombe (*P. H. G.*), Penzance (*R. Q. C.*), Isle of Man (*West*),

\* See also *Proceedings of the Royal Society*, vol. xxii. No. 151.

† "Die Actinien," Professors Hertwig, Jena, 1879.



Menai Straits (*A. S. P.*), &c. Height—large, with tentacles 3—4 in. long, diam. of base to 6 in., of column 2 in.

Colour. (a) *Smaragdina*: Column brown, with narrow bands alternately paler and deeper. Disc brown. Tentacles green with rosy tips. (b) *Sulphurea*: Tentacles pale yellow with lilac tips. (c) *Alabastrina*: Column and disc olive. Tentacles white. (d) *Rustica*: Brown. Tentacles grey. (e) *Punicea*: Tentacles mahogany-red.

In shape this species has been likened to a dice-box. The margin is crenate. The tentacles are about 180 in four rows. They are very long and snake-like.

The animal may be easily kept in captivity, and, from the absence of strong muscular contraction, forms a good subject for dissection. It is, however, credited with the power of causing unpleasant sensations if touched by the hand, especially if the *Anthea* be unhealthy or suffering from long confinement.

The French occasionally eat this species, especially in Provence. Mr. Gosse says that he has tried the dish, and "would not dare to say that an Opelet is as good as an Omelet; but *chacun à son gout*."

#### SUB-FAMILY IV. BUNODIDÆ, Gosse.

*Actininæ* having the column studded with persistent well-developed warts or tubercles, and without marginal spherules or acontia.—GOSSE.

GENUS I. BUNODES, Gosse. (*Βουνώδης*, studded with prominences.)

*Body wall* studded with numerous permanent rounded warts (papillæ), set in vertical lines corresponding with

the intraseptal spaces. *Tentacles* perfectly retractile.  
—GOSSE.

This genus is provisionally placed by Professor Hertwig amongst the Sagartidæ.

1. B. GEMMACEUS, *E. and S.* "The Gem Pimplet."

*Actinia gemmacea* (*E. and S.*, *G. J.*, *Cocks*, *R. Q. C.*, *D. L.*, *P. H. G.*), *A. verrucosa* (*Penn.*, *Lamk.*, *Rapp*), *Cribrina verrucosa* (*Ehr.*), *Cereus gemmaceus* (*M. Edwards*), *A. bimaculata* (*Grube*).

Hab.: Guernsey (*Holdsworth*), Torquay, Ilfracombe (*P. H. G.*), Douglas (*West*). Height 1—2 in.

Colour. Grey or flesh-coloured, with six equidistant longitudinal bands of white primary warts. There are secondary and tertiary rows of warts of a bluish or reddish-grey colour, and a quaternary row of indefinite colour. Disc bluish-grey, with scarlet and blue radial lines. Tentacles greyish with half a dozen well-defined white spots.

The tentacles number 48, as do the rows of warts, each row of warts corresponding with a tentacle. These warts are perforated, so that water can be ejected through them.

This species is easily kept in aquaria, and is very prolific.

2. B. THALLIA, *Gosse*. "The Glaucous Pimplet."

*Cereus thalia* (*M. Edw.*).

Hab.: Ilfracombe (*P. H. G.*). Height 2 in.

Colour. Bluish-green, with about 36 longitudinal rows of dark-coloured warts, about 25 in each row. Disc blackish with yellow radii alternately long and short. Tentacles 48 in four rows, grey with numerous white spots.

Mr. Gosse describes two varieties—*Xeroxyla*, with a

dingy brown column and disc, and *Caustozyla*, with a reddish-brown column and dark olive disc—in addition to the ordinary form, which he names *Hyrgosyla*. The warts of this species are used as suckers.

3. B. BALLII, *Cocks*. "The Red-speckled Pimplet."  
*Actinia Ballii* (*Cocks*), *A. clavata* (*Thompson, P. H. G., Fugwell, Jordan*), *B. clavata* (*P. H. G.*), *Cereus clavata* (*M. Edw.*).

Hab.: Ventnor, Torquay (*P. H. G.*), Falmouth (*Cocks*). Height  $\frac{1}{4}$  in., diam. of expanse 2 in.

Colour. (a) *Rosea*: Base red. Column yellow, speckled with red both in the warts and interspaces. Disc grey with white specks. Tentacles pale yellow tinged with rose sprinkled with white. (b) *Dealbata*: Tentacles cream-white. (c) *Funesta*: Tentacles umber, disc smoke-black, both speckled with yellowish-white. (d) *Livida*: Tentacles and disc bluish-grey or green, speckled.

The tentacles number 72 in five rows; they are long and slender.

The warts are arranged in 48 rows.

"It ranges in tolerable abundance from Hampshire to the Lizard."

## GENUS II. AULACTINIA, *Verril*.

*Column* irregularly distensible, not mucous, versatile with vertical rows of warts. No suckers or cinclides. *Tentacles* scarcely retractile.

1. A. ALFORDI, *Gosse*.

*Ægeon* Alfordi (*P. H. G.*).

Colour. Base brick-red. Column pea-green, flaked with purple and spotted with red. Disc green, with a

central zone of greyish-purple. Tentacles vivid green, with longitudinal lines of grey.

Base adherent to rocks with moderate tenacity, broader than diameter of column. Column very distensible and versatile, not mucous, with tentaculate margin. Body wall longitudinally fluted, each flute having a single vertical row of minute warts. Tentacles numerous in several rows, scarcely retractile.

Described as a new species by Mr. Gosse, *Ann. of Nat. Hist.*, 1865 (July), 41.

GENUS III. BOLOCERA, *Gosse*. (*βάλλω*, to throw, *κέρας*, a horn.)

*Body wall* smooth, studded with small warts remotely scattered. *Tentacles* short, thick, constricted at foot, obtusely pointed, not retractile.—GOSSE.

1. B. TUEDIÆ, *Johnston*. "The Deeplet."

*Actinia Tuediæ* (*G. J.*), *Anthea Tuediæ* (*G. J., Cocks, D. L., P. H. G., Ald.*), *Anemonia Tuediæ* (*M. Edw.*).

Hab.: Peterhead (*C. W. P.*), Cullercoats (*Ald.*), Cumbræ (*D. L.*), from deep water. Height 3—4 in. Diameter when expanded 7—8 in.

Colour. Deep flesh colour, with reddish tentacles.

This very large species is found in deep water, and Mr. Alder states that separate tentacles, which appear to be readily detached, are frequently brought in on the fishing-lines. It is from this disposition to part with the tentacles, that the generic name is given.

The body is studded with roundish warts, "resembling the heads of small pins in a pincushion" (*Cocks*). The tentacles are in three rows, and are very large, each tentacle sometimes  $\frac{1}{2}$  in. in diameter.

2. B. (?) EQUÆ, *Gosse*. "The Ringed Deeplet."

Hab.: Redcar, Banff. From 28 fathoms. Height 4 in.

Colour. Orange-scarlet, with small white ringed warts. Disc drab. Tentacles pellucid, with two rings round the middle, one broad and scarlet, the other opaque-white.

The tentacles are 144 in six rows, short and thick. Though not themselves retractile, they are yet capable of being covered over by "the contraction of the margin till its edges meet over the tentacles, but never involving itself."

This appears to be a rare deep-water species.

#### GENUS IV. TEALIA, Gosse.

In honour of Mr. T. P. Teale, of Leeds.

*Body wall* covered with numerous irregularly scattered warts. *Body* broader than high. *Tentacles* numerous, equal, retractile.—GOSSE.

Professor Hertwig assigns this genus to a family *Tealidæ*.

1. *T. DIGITATA*, Müller. "The Marigold Wartlet."

*Actinia digitata* (Müll., Ald.), *Cereus digitata* (M. Edw.).

Hab.: Cullercoats (Ald.). Height  $1\frac{1}{2}$  in.

Colour. Scarlet-orange, with paler warts and dull red disc and tentacles.

The tentacles are numerous and stout, unbanded, but darker in colour towards the tips.

The surface of the column is studded with transverse rows of large warts.

It is found on shells in deep water.

2. *T. CRASSICORNIS*, Müller. "The Dahlia Wartlet" or "Crass." Plate XIV. fig. 2.

*Actinia felina* and *A. senilis* (*Linn.*), *A. crassicornis* (*Müll.*, *Fabr.*, *Cocks*, *G. J.*, *P. H. G.*, *D. L.*, *Ald.*), *A. Holsatica* (*Müll.*), *A. ? fiscella* (*Müll.*), *A. ? bimaculata* (*Grube*), *A. coriacea* (*Cuvier*, *Rapp.*, *Teale*, *Cocks*, *Tugwell*, *G. J.*, *D. L.*, *Ald.*), *A. gemmacea* (*Dalyell*, *G. J.*, *R. Q. C.*), *Rhodactinia Davesii* (*Agas.*, *Verril*), *Cribrina coriacea* (*Ehr.*), *Isacmæa papillosa* (*Ehr.*), *Bunodes crassicornis* (*P. H. G.*, *C. Kingsley*), *Tealia Greenii* (*Wright*, *P. H. G.*), *T. tuberculata* (*Cocks*, *P. H. G.*).

Hab.: Generally distributed. Height 2 in., diam. 3 in.

Colour. Sir John Dalyell says, "No species is equally diversified in colour and aspect. Red is usually predominant. The surface of many is variegated red and white like a rose, or with orange, green, and yellow intermixed (*meloides*). One is almost totally white (grey, *vilis*), another dull crimson (*purpurea*), another wholly primrose-yellow (*aurea*). It may be truly affirmed that the diversities baffle enumeration and description." The italics are the names of the varieties as given by Mr. Gosse.

The surface of the column is covered with warts, to which stones and shells adhere. The tentacles are conical, and number 80 arranged in five rows.

No one who has once seen this species can doubt or mistake its identity. It is one which may be kept with ease in an aquarium, and there forms an object of great interest. It appears to be able to alter very considerably the shape of the tentacles, and to distend them with water until quite transparent. It also distends its whole body very greatly, its œsophagus being often completely exposed by eversion, in consequence of the quantity of water imbibed. It also has a very common habit of extending single tentacles to a con-

siderable length. The tentacles are very adhesive, as may be proved by experience.

Dr. Landsborough has the following significant quotation relating to the treatment of this species by the natives of Italy and the South of France: "Ils la lavent fort et souvent, puis la fricassent légèrement en la poêle, et après cela ils la mangent avec beaucoup de plaisir."

GENUS V. *HORMATHIA*, *Gosse*. (ὄρμαθος, a necklace.)

*Body wall* corrugated, surrounded by a single row of warts. *Tentacles* moderately long and slender, perfectly retractile.—*GOSSE*.

A somewhat doubtful genus described from a single specimen of the species following.

1. *H. MARGARITÆ*, *Gosse*. "The Necklet."

*Hab.*: Moray Firth. (A single specimen.) Deep water. Height 2 in.

*Colour*. White, with purplish tentacles.

There is a row of about 10 large round warts below the disc. The tentacles are arranged in two or three rows. The column is much corrugated.

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GENUS *STOMPHIA*, *Gosse*. (στόμφος, wide-mouthed.)

*Body wall* much corrugated, without warts or suckers. *Tentacles* perfectly retractile.—*GOSSE*.

This genus is placed by Mr. Gosse amongst the *Bunodidæ*, between which sub-family and the *Sagartidæ* he considered it an intermediate form. As Dr. Andres, however, points out, it has neither the warts

of the *Bunodidæ* nor the acontia of the *Sagartidæ*, and its position is doubtful.

1. S. CHURCHILÆ, *Gosse*. "The Gapelet."

Hab.: Scottish Coasts, from deep water; Redcar. Height  $2\frac{1}{2}$  in.

Colour. (a) *Lychnucha*: Cream-white to yellow, with scarlet dashes. Disc and tentacles white, the latter marked with three scarlet rings and two stripes. (b) *Incensa*: Red with yellow dashes. (c) *Extincta*: White. (d) *Pyriglotta*: As (a), but very large, and resembling *T. crassicornis*.

Tentacles about 60 in four rows. The disc is often conically protruded. This feature, coupled with the horizontal carriage of the tentacles, and the very changeable shape of the column, causes the anemone to assume a curious appearance. The disc is generally marked with distinct radii.

#### SUB-FAMILY V. ILYANTHIDÆ.

*Actinincæ* having the aboral (proximal) end rounded. Without pedal disc. Septa more than twelve. Mouth not furnished with a conchula.

GENUS I. ILYANTHUS, *Forbes*. (ἰλῦς, mud, and ἄνθος, a flower.)

Pear-shaped, tapering to a blunt point, not perforated. Surface quite smooth. Tentacles marginal, numerous.—*Gosse*.

1. I. SCOTICUS, *Forbes*. "The Scottish Pearlet."  
Plate XIV. fig. 4.



*Iuanthos Scoticus* (*Forbes, Thomson, M. Edw., G. J., D. L.*).

Hab.: Lochryan (*Forbes*), Balbriggan, Ireland (*Mrs. Hancock*). Length  $1\frac{1}{2}$  in.

Colour. Pink, with white stripes and greenish tentacles.

A free actinoid, with 44 long filiform tentacles.

2. *I. MITCHELLII*, *Gosse*. "The Scarlet Pearlet."

*Iuanthos Mitchellii* (*P. H. G., M. Edw.*).

Hab.: Weymouth (*P. H. G.*). Length 2 in.

Colour. Scarlet, with variegated (purplish-black, white and red) disc. Tentacles (about 36 in two rows, thick and conical) white, with bands of white and purple.

#### SUB-FAMILY VI. SIPHONACTINIDÆ.

*Body pear-shaped or cylindrical. Tentacles not more than 12. Mouth furnished with a single gonidial groove, the edges of which are soldered so as to form a tube, terminating in a thickened expanded rim (conchula), the margin of which is divided.*

GENUS SIPHONACTINIA, *Danielsen and Koren*.

*Species* having the proximal end perforate. *Surface* smooth, but studded with minute suckers. *Tentacles* twelve.

1. *S. HASTATA*, *Gosse*. "The Arrow Muzzlet."

*Peachia hastata* (*P. H. G.*).

Hab.: Torbay (*P. H. G.*), St. Andrew's (*McIntosh*). Length 4 in.

Colour. Pale red, with twelve white lines marking the septa, distal part brownish. Disc pale red, each radius marked with two V's. Tentacles pellucid, each with two rows of deep brown arrowhead-like marks.

The *conchula* has from 12—20 lobes, mostly bifid.

In this and the other species of this genus the tentacles are marginal, 12 in number, short, thick, and tapering.

2. *S. UNDATA*, *Gosse*. "The Waved Muzzlet."

*Peachia undata* (*P. H. G.*).

Hab.: Guernsey, Herm. Length  $1\frac{1}{2}$  in.

Colour. Pale yellow, with red splashes. Disc cream-white. Tentacles white, with seven waved brown bands on the front of each. Conchula with 5 lobes.

Tentacles generally "borne like a 12-rayed star." They are very contractile.

3. *S. TRIPHYLLA*, *Gosse*. "The Trefoil Muzzlet."

*Peachia triphylla* (*P. H. G.*).

Hab.: Channel Islands. Length 3 in.

Colour. Pale red-brown, with splashes of darker colour. Disc buff, radii marked with a brown spot on each. Tentacles pellucid, with a double row of brown arrow-heads, and a brown circle round the disc at the base of the tentacles.

"The conchula bears 3 ovate or leaf-like lobes."

#### SUB-FAMILY VII. HALCAMPIDÆ.

*Actininæ* having only twelve septa. Body vermicular, with the posterior end rounded, and capable of being distended into a vesicle. Mouth not furnished with a conchula.

GENUS HALCAMP, *Gosse*. (ἅλς, the sea, κάμπη, a maggot.)

Tentacles twelve, retractile. Surface studded with minute suckers. Œsophagal grooves indistinct or wanting.

1. *H. CHEYSANTHELLUM*, *Peach*. "The Sand Pintlet."

*Actinia chrysanthellum* (C. W. P., G. J., Cocks, D. L.),  
*Peachea* (?) chrys. (P. H. G.).

Hab.: Fowey, Cornwall (*Peach*). Length  $1\frac{1}{4}$  in.,  
 diam.  $\frac{1}{2}$  in.

Colour. Drab-white. Disc pale blue, with 12 dark brown triangular rays, each ray terminating in a V shaped figure. Tentacles brown, with 6 rings of white.

The generic name, signifying "sea maggot," well describes the vermicular form of this and the succeeding species. It is fond of distending the proximal end into a thin bladder-like shape. It lives in sand, buried up to the disc. The tentacles are 12, set at the margin of the disc.

GENUS ARACHNACTIS, Sars. (*ἀράχνη*, a spider.)

*Column* rounded at proximal extremity, but not swollen, imperforate. *Tentacles* of two kinds, marginal long, gular short, not retractile. Freely swimming in the sea.—GOSSE.

1. *A. ALBIDA*, Sars. "The Sprawlet."

Hab.: The Minch (*Balfour and Forbes*). Length  $\frac{1}{2}$  in.

Colour. Whitish tinged with tawny. Tentacles white and brown.

Under this name Mr. Gosse describes a natatory anemone, which had been found twice in the Hebrides, and abundantly by Sars on the coast of Norway. He describes it as "looking not unlike a long-legged spider."

This species appears, however, to be an immature form of *Cerianthus*, and as such is described by Dr. Andres.

## FAMILY II. EDWARDSINÆ (EDWARDSIÆ).

*Septa 8, two pairs of directive septa, the remaining four not paired. All the septa furnished with reproductive organs. Tentacles simple, usually more numerous than the septa.*—HERTWIG.

SUB-FAMILY EDWARDSIÆ, *Hertwig and Andres.*

*Characters as above.*

GENUS EDWARDSIA, *Gosse.*

*Column* long, cylindrical, divided into three regions, the *capitulum*, or anterior region, the *scapus*, covered by a thick and opaque epidermis, and the *physa*, thin, pellucid, and inflatable. *Tentacles* few (less than twenty), retractile.—GOSSE.

1. *E. BEAUTEMPSEI*, *Quatrefages*. "The Painted Pufflet."

*Scolanthus callimorphus* (*P. H. G.*), *E. Callimorpha* (*P. H. G.*).

*Hab.*: Weymouth (*P. H. G.*), Brixham (*C. Kingsley*).  
Length  $\frac{3}{4}$ — $2\frac{1}{2}$  in.

*Colour.* *Capitulum*: Pillar-like, chocolate-brown, with lozenge-shaped and triangular white markings. *Scapus*: Orange-yellow. Disc white, with sienna star. *Tentacles* transparent, with white markings.

This is a deep-water species. It and the next are distinguished by the pillar-like *capitulum*, extending below the disc to the *scapus*. They can puff out the *physa* into a bladder-like form. *E. Beautempsii* buries itself in the sand, and generally only extends the *capitulum*.

GENUS II. EDWARDSIELLA, *Andres.*

*Column* as in preceding genus. *Tentacles* twenty and upwards.

1. *E. CARNEA*, *Gosse*. "The Crimson Pufflet."

Hab.: Torquay (*P. H. G.*), Tenby. Length 1 in., diam.  $\frac{1}{10}$  in.

Colour. *Capitulum*: Translucent, with pink tinge, showing the oesophagus "as a rich scarlet axis." *Scapus*: Rose-tinted. Disc a cream-white star. Tentacles pink, with bands of more opaque colour.

This species has 28 tentacles, arranged in three rows.

It lives in eroded rocks, "in the old burrows of the Mollusc *Saxicava*."

2. *E. ALLMANI*, *McIntosh*.3. *E. GOODSIRI*, *McIntosh*.

These two species have been described as new by Mr. McIntosh (*Proc. R. S. Edin.*, 1864). They were found by him at St. Andrews.

FAMILY III. CERIANTHINÆ (*CERIANTHEÆ*).

*Actiniaria* with numerous unpaired septa, and a single ventral oesophageal groove. Septa alternately fertile and sterile, longest on the dorsal side, and gradually diminishing towards the dorsal aspect.—*HERTWIG*.

SUB-FAMILY CERIANTHIDÆ, *Hertwig and Andres*.

*Tentacles* in two rows, marginal principal, circumoral accessory. *Posterior* of body rounded without sphincter.

GENUS CERIANTHUS, *Della Chiage*.

*Column* lengthened bulb-like at proximal extremity, perforated with a distinct orifice, expanding trumpet-like into the tentacles. Enveloped in a loose non-adherent tube or sheath of mud, sand, cnidæ, &c., of tough membranous texture. *Tentacles* non-retractile.—*GOSSE*.

1. *C. LLOYDII*, Gosse. "The Vestlet."

*Edwardsia vestita*, C. membranaceus (*P. H. G.*, *Von Heider*), *C. Borealis* (*Daniellson*).

Hab.: Menai Straits (*E. Edwards*, *A. S. P.*), Herm (*Holdsworth*), St. Andrews (*McIntosh*). Length to 7 in.

Colour. Pale buff to chestnut-brown. Tentacles chocolate-brown, with white and chestnut bands.

The marginal tentacles are arranged in two rows, and are 64 in number. The oral tentacles are in four irregular circles.

The peculiarity of this species is the investing tube, which can easily be detached. It is largely composed of "cnidæ, the discharged ecthorea of which intertwine, and form a sort of felt."

It is a difficult species to secure, as it readily retires into and even slips through its sac and escapes. The only way to secure it is to have two or three spades so as to raise the ground on all sides at once.

The anatomical characteristics of this species have been investigated by Professors Hertwig, and more recently by Von Heider.\* Herr G. von Kock has discovered that the tentacles have a series of fissures or openings for the discharge of water, a fissure being placed between every two of the dark ring-like bands.

## FAMILY IV. STICHODACTYLINÆ, ANDRES.

*Actinaria* furnished with tentacles disposed in radial series.—ANDRES.

## SUB-FAMILY I. CORYNACTIDÆ, Andres.

*Stichodactylinæ* with equal capitate tentacles.

\* For summary of these investigations see J. R. M. S., vol. iii. (1880), 457.

GENUS I. *CAPNEA*, Forbes. (*καπνη*, a chimney.)

*Body* cylindrical. *Body wall* smooth, invested with a woolly epidermis. *Tentacles* short, truncate, capitate, retractile.—GOSSE.

*C. SANGUINEA*, Forbes. "The Crock."

*Kapnea sanguinea* (Forbes).

*Hab.*: Isle of Man (Forbes), Falmouth (Cocks).

*Height* 1 in., diam.  $\frac{1}{2}$  in.

*Colour.* Vermilion, with brown epidermis and orange-scarlet tentacles.

The tentacles number 48, in three rows of 16 each.

It is an active creature, always more or less tubular in shape, like a chimney-crock or steamboat funnel. The tentacles are not unlike the "embrasures on the top of a turret." The lower two-thirds of the body are covered by a woolly epidermis.

GENUS II. *CORYNACTIS*, Allman. (*κορυνη*, a club, *ακτίς*, a ray.)

*Body* subcylindrical, but very mutable, adhering by an expanded base, and with no separable epidermis. *Tentacles* tubular, conical, capitate, retractile, in several rows.—ALLMAN.

1. *C. VIRIDIS*, Allman. "The Globehorn."

*C. Allmanni* (Thompson, Cocks, P. H. G., E. P. Wright).

*Hab.*: Torquay (P. H. G.), Fowey (C. W. P.), Lundy (C. Kingsley), Crookhaven (Allman). *Height*  $\frac{1}{2}$  in.

*Colour.* (a) *Smaragdina*: Emerald green. Tentacles transparent, with pink knobs. (b) *Rhodoprasina*: Rosy-lilac. Tentacles umber, with white knobs. (c) *Tephрина*: Pearl-grey, with brown tentacles. (d) *Chrysochlorina*: Pale yellow-green. Tentacles maroon, with white knobs. (e) *Prasococcina*: Pearl-grey, with

pale scarlet tentacles. (f) *Corallina*: Scarlet, with white tentacles. (g) *Coina*: All white.

Tentacles about 92, in five rows, each with a pillar-like stem and a globular head. They increase in size towards the disc.

Mr. Gosse describes this as a "most exquisitely lovely little gem." It is easily kept in aquaria, being very tenacious of life.

#### SUB-FAMILY II. AURELIANIDÆ, *Andres*.

*Stichodactylinæ with tentacles, not only capitate but more or less bilobate, and differing in form in the different rows.*—ANDRES.

#### GENUS I. AURELIANA, *Gosse*.

Named after the Roman Emperor Aurelianus.

*Body* subcylindrical. *Body wall* smooth and firm, with a deciduous epidermis. *Tentacles* short, knobbed, and retractile, more or less bilobate and varying in form.—GOSSE.

1. *A. AUGUSTA*, *Gosse*. "The Crimson Imperial."

*A. regalis* (*Andres*).

*Hab.*: North Devon. Height 1—1½ in., diam. of base 2¾ in.

*Colour*. Crimson, with rosy-white tentacles.

This anemone rises from a wide disc, gradually narrowing to a diameter of 1 inch. The tentacles are arranged in four rows (36 in each), and are very short and knobbed.

2. *A. HETEROCERA*, *W. Thompson*. "The Yellow Imperial."

*Corynactis heterocera* (*Thompson, Gosse, Wright*).

*Hab.*: Weymouth. Height and diam. 1 in.



Colour. Yellow, with rosy-white tentacles and white disc.

The tentacles number 120 in four rows. The tips are knobbed, and are sometimes two-lobed. The tentacles are short and thick, and generally borne horizontally. "They resemble a coronet of pearls."

#### FAMILY V. ZOANTHINÆ (ZOANTHÆ).

*Actiniaria with numerous septa of different kinds, small imperfect microsepta and large perfect macrosepta, with reproductive organs and mesenteric filaments. Animals forming colonies.*—HERTWIG and ANDRES.

##### SUB-FAMILY I. ZOANTHIDÆ, Gosse.

*Animals forming colonies, the individuals of which are connected by endodermal canals, which run out from the gastric space at the lower end of each polyp.*—HERTWIG.

##### GENUS I. POLYTHOA, Klunz.

*Colonies connected by a slightly developed cœnenchyma, consisting either of a plexus of stolons or a thin plate, the polyps projecting to a considerable height above the cœnenchyma, which is invested with sand.*

1. P. ARENACEA, *De Chiage*. "The Sandy Creeplet."

*Dysidea papillosa* (G. J.), *Sidisia Barleei* (Gray), *Zoanthus Couchii* (G. J., D. L., P. H. G., &c.).

Hab.: Northumberland (*Ald.*), Torquay (*Holdsworth*), Cornwall (*Couch*). Height  $\frac{3}{8}$ — $\frac{1}{2}$  in.

Colour. (a) *Linearis*: Pale brown, with transparent white-tipped tentacles, having the root-band as a narrow ribbon. (b) *Diffusus*: Having the root-band spread over a shell as a continuous carpet. (c) *Liber*: Un-

attached, the root-band being a cylinder of the same diameter as the column of the polyp.

This is a small species, the several polyps being connected by an incrusting fleshy root-band. When contracted the polyps resemble split peas.

The tentacles number 28, in two equal rows. The epidermis is invested with fine sand, of colours varying with the locality.

The coenenchyma is very sensitive, and any irritation is communicated to the colony.

Mr. Gray (Proc. Zool. Soc., 1867, 233—240) proposes the genus *Carolia* for var. (a), and the genus *Epizoanthus* for var. (b). Dr. Andres considers all the forms described as forming variety *Couchii* of this species.

## 2. *P. SULCATA*, Gosse.

*Zoanthus sulcatus* (P. H. G.).

Hab.: Torbay. Height  $\frac{1}{8}$  in.

Colour. Olive, owing to presence of pigment granules.

This exceedingly minute species was found by Mr. Gosse to the number of 60 in a space of  $1\frac{1}{2}$  in. square. The epidermis contains a few sand grains, but not so as to be conspicuous, as in the preceding species.

## GENUS II. ZOANTHUS, Cuvier.

As last genus, but without sand incrustations.

### 1. *Z. ALDERI*, Gosse.

Hab.: Cullercoats (*Ald.*). Height  $\frac{1}{8}$  in.

Colour. Milk-white.

In this species the polyps are set in single file, and are free from all sand incrustations.

Full details are wanting as to nature of tentacles, &c.

SUB-ORDER: **SCLERODERMATA.**

(MADREPORARIA.)

*Animals depositing a corallum.*

SECTION 1. APOROSA. Corallum solid and imperforate.

## FAMILY I. TURBINOLIDÆ.

*Corallum solid, simple, or in colonies, with the lamellar interspaces reaching to the bottom of the cavity, and perfectly free.*GENUS I. CARYOPHYLLIA, *Lamarck, in part.**Corallum* simple, obconic, with a permanently adherent expanded base, or a more or less pointed non-adherent base. *Plates* usually forming 6 systems, with a single circle of palules. *Columella* composed of fascicular, twisted, vertical plates. *Ribs* developed towards the summit.—GOSSE.1. C. SMITHII, *Harvey*. "The Devonshire Cup Coral." Plate XIV., fig. 6.C. cyathus (*Flem.*), C. sessilis (*Bellamy*), ? Turbinolia borealis (*Dana, Flem., D. L.*), Cyathina Smithii (*Dana, M. Edwards, P. H. G.*), Madrepora cyathus (*E. and S.*).Hab.: Devon and Cornwall, Oban, Shetland, Guernsey, Irish coasts. Height  $\frac{1}{8}$ —1 in.Colour of anemone. (a) *Castanea*: Bay or fawn, lined with chestnut. Disc white. Tentacles colourless, with rosy-white heads. (b) *Esmeralda*: as (a) but the chestnut replaced by green. (c) *Clara*: White.

In this species the corallum is fixed by a broad base; the plates are arranged in 6 systems and 5 cycles, each system being arranged as follows:

1 5 4 5 3 5 4 5 2 5 4 5 3 5 4 5 1.

Some of the systems have not the plates of the fifth cycle.

The corallum has a series of ribs outside, prominent on the upper half. The animal itself is like an ordinary anemone, and is able to expand itself considerably above and around the corallum. The columella is very distinct, as are also the palules, which form an inner series between the plates proper and the columella.

The tentacles number about 50, in three rows. The head of each is opaque white, covered with palpcils, and the stem is covered with warts, generally of a chestnut colour.

*C. Smithii* is found firmly attached to rocks in deep water. Mr. Couch ("Cornish Fauna," iii. 72) states that there is scarcely a stone drawn from deep water but has several specimens attached to it.

#### GENUS II. PARACYATHUS, *M. Edwards and Haime*.

*Corallum* turbinate or cylindrical, with a permanently adherent expanded base. *Palules* in 2 or more circles. *Plates* nearly equal in 4 or 5 cycles and 6 systems. *Ribs* distinct, straight.—GOSSE.

Mr. Gosse refers the three following species to this genus with some hesitation. They were all described by him for the first time in his "Actinologia Britannica."

1. *P. TAXILIANUS*, *Gosse*. "The Moray Cup Coral."

Hab.: Moray Firth. Height 21—14 in.

Animal unknown.

Described by Mr. Gosse from a single specimen. "The plates are in 5 imperfect cycles; calyx elliptical; ribs notched above, granulous below."

2. *P. THULENSIS*, *Gosse*. "The Shetland Cup Coral."

Hab.: Shetland Islands, Moray Firth. Height 1 in.  
Animal unknown.

"Plates in 4 imperfect cycles; calyx circular.  
Height equal to half the diameter."

3. *P. PTEROPUS*, *Gosse*. "The Winged Cup Coral."

Hab.: Moray Firth. Height .05 in.

Animal unknown.

"Plates in 4 imperfect cycles; calyx circular; ribs  
very prominent, dilating into wings below."

GENUS III. SPHENOTROCHUS, *M. Edw. and Haime*.

*Corallum* simple, free, wedge-shaped. *Columella* a single lamina, lobed or knobbed at the free surfaces on the floor of the calyx. No *palules*. *Plates* in 3 cycles, 6 systems. *Ribs* projecting.

1. *S. MACANDREWANUS*, *M. Edwards*. "The Smooth-ribbed Wedge Coral."

*S. Andrewianus* (*M. Ed. and H.*), *Turbinolia millertiana* (*Thompson, E. P. Wright, G. J., P. H. G., D. L.*)

Hab.: Off Scilly (*McAndrew*), Arran Island (*Barlee*).  
Height  $\frac{1}{2}$  in.

Animal undescribed.

"This is a beautiful little coral, shaped like a boy's top, with 24 longitudinal ribs."—*Landsborough*.

2. *S. WRIGHTII*, *Gosse*. "The Knotted Wedge Coral."

Hab.: Antrim coast.

Animal unknown.

Inserted by Mr. Gosse amongst the British fauna on the authority of four specimens dredged amongst shell-sand by Mr. Hyndman. It is exceedingly minute, not exceeding 0.155 in. in height, and is not improbably a fossil species.

## GENUS IV. FLABELLUM, Lesson.

*Corallum* simple, free, turbinate, on a very short, crooked, pointed base. *Columella* slightly developed. No *palules*. *Ribs* indistinct.

1. F. ARCTICUM, Sars. "The Scarlet Crisp Coral."

*Flabellum* MacAndrewi (Gray), *Ulocyathus* arcticus (P. H. G.).

Hab.: Deep water off Shetland. Height  $1\frac{1}{2}$  in.

Colour of animal, orange-scarlet; with 140 tentacles in four rows. The largest of simple European corals. Described as British on authority of one specimen dredged by Mr. MacAndrew, twenty-five miles off East Shetland, in ninety fathoms. It appears to be common at the North Cape, Norway, at a depth of 150—200 fathoms.

## FAMILY II. OCULINIDÆ.

*Corallum* solid, branching.

GENUS LOPHOHELIA, M. Edw. and Haime.

*Corallum* tree-like, walls very thick, scarcely ribbed. No *columella* or *palules*.

1. L. PROLIFERA, Linn. "The Tuft Coral."

*Madrepora* prolifera (Linn., E. and S., Esper.), *Lithodendron* proliferum (Schweigger), *Oculina* prolifera (M. E. and H.).

Hab.: Skye, Rum, Orkney. Height of colony up to 10 in.

This is the only branching coral found in Britain. The animal is unknown. It forms a "massive, compact, many-branched tree, rising from a slender base."

## FAMILY III. ASTRÆIDÆ.

## SUB-FAMILY ASTRÆIDÆ REPTANTES.

*Corallum solid, composed of short corallites, arising by gemmation on stolons, or on basal membraniferous expansions.*

GENUS PHYLLANGIA, *Milne-Edwards and Haime.*

*Corallites* short, increasing as described. *Ribs* thin, indistinct. *Columella* with a surface of papillæ. No *palules*.—GOSSE.

1. *P. DUROTRIX*, *Gosse*. "The Weymouth Carpet Coral."

*Phyllangia Americana* (*P. H. G.*), *Hoplangia durotrix* (*P. H. G.*).

Hab.: Weymouth Bay. Height  $\frac{1}{4}$  in.

Animal undescribed.

This is a small but interesting coral. The corallites are grouped on stolons or membranous expansions. The plates are in 6 systems and 4 imperfect cycles. Mr. Gosse describes the wall as surrounded by a thin, porcellaneous coat (*epitheca*), which he considers a prominent feature of the species.

SECTION II. PERFORATA. *Corallum* composed almost entirely of porous or reticular cœnenchyma.

## FAMILY I. EUPSAMMIDÆ.

*Corallum simple, porous. Wall perforate. Septal arrangement like a six- or twelve-rayed star. Plates perforate.*

GENUS BALANOPHYLLIA, *Wood.*

*Corallum* simple, adherent, cylindrical. Well-developed *columella* of a sponge-like appearance.

1. *B. REGIA*, *Gosse*. "The Scarlet and Gold Star Coral."

Hab.: Ilfracombe (*P. H. G.*), Lundy (*C. Kingsley*).  
Height  $\frac{1}{6}$ — $\frac{1}{4}$  in.

Colour. Scarlet, with gamboge-yellow tentacles.

The corallum of this species may be easily recognized by the septal plates, which are jagged, and are arranged like a distinct six-rayed star.

Mr. Gosse describes the circumstances of the discovery of this coral as follows: "I was searching amongst the rugged rocks that run out from the tunnels, and managed to scramble down into one of the cavities between the rocks. There I found a sort of oblong basin in which the water remained, a tide-pool of three feet depth in the middle. The whole cavity was so smooth that I could find no resting-place for my foot in order to examine it; though the sides, bristling with Coralline and Zoophytes, looked so tempting that I walked round and round reluctant to leave it. At length I fairly stripped, though it was blowing very cold, and jumped in. I had examined a good many things, and was just about to come out when my eye rested on what I at once saw to be a Madrepore, but of an unusual colour, a most refulgent orange. It was detached by means of a hammer, and proved to be a new and interesting form."



**ACTINOZOA (ANTHOZOA).****II. ALCYONARIA.***Description.*

There are few species of the Alcyonaria found in British seas, but those which are obtained there are very representative. The Alcyonaria differ from the Zoantharia in being always compound, and yet not assuming a truly coralline form. The polyps have eight short fringed tentacles and septa arranged in multiples of 4, which, however, are not paired. The British species are distributed amongst five families, each of which has characteristics sufficiently striking to require detailed mention. The families are the *Alcyonidæ*, *Gorgonidæ*, *Pennatulidæ*, *Virgularidæ*, and *Funiculinidæ*.

Before, however, setting out the family differences, the polyps, which are alike in all the families, should be described. Each polyp is a transparent animal, in shape when extended somewhat like a truncated cone, and having eight pinnately fringed tentacles surrounding the mouth. Plate XV., fig. 1. The body wall is extended above round the tentacles into a calyx with pointed processes. This wall, like that of the Zoantharia, consists of an ectoderm, mesoderm, and endoderm, with the usual layers of muscular fibres between the endoderm and mesoderm. The tentacles are eight hollow extensions of the body wall. They are fringed pinnately on each side by eight or ten hollow pinnules. The ectoderm of the tentacles contains the usual armament of thread-cells, which are oval in shape, and contain spirally coiled threads. There is no distinct disc, as in the

Zoantharia, but the mouth, which is a mere slit, opens into the œsophagus, which leads into the stomach. The latter communicates directly with the body cavity. The endodermal cells of the stomach often contain granular particles of a dark colour, of doubtful function. The mesenteries or septa connect the stomach with the body wall, and divide the body into chambers. Plate XV., fig. 2. The structure of the septa is similar to that of the same organs in the Zoantharia, consisting of a mesoderm, lined on each side by endodermal cells, and well provided with muscular fibrillæ. The mesenteries extend below the stomach, and hang downwards towards the bottom of the body cavity. These filaments occur in two forms,—*long filaments*, which are slender and reach to the bottom of the body cavity (there are two of these), and *short filaments*, which are thicker and shorter. The filaments have thickened, cord-like edges, which are analogous to the *craspeda* of the Zoantharia, and generally contain thread-cells. The polyps, like those of the Hydroids, are connected with each other by canals which extend throughout the *cœnenchyma*, or fleshy substance of the colony.

Reproduction is by ova, and gemmation. The ova are developed in ovaries sometimes borne at the free ends of the short mesenteries, and sometimes placed in expansions of the cœnenchymal canals. The sexes are believed to be distinct, each colony being either male or female.

In addition to the mature and perfect polyps there are also in the Pennatulida rudimentary polyps, which have neither tentacles nor reproductive organs. Their function is supposed to be to preside over the introduction of sea water into the colony.

Those readers who desire a fuller description of these animals will find it, so far as the Pennatulida are concerned, in the "Report on the British Pennatulida," presented to the Birmingham Natural History Society by Prof. A. Milnes Marshall and Mr. W. P. Marshall in 1882. This may be found in the "Midland Naturalist" for that year.

The distinguishing features of each family may now be noticed.

In the *Alcyonidæ* the zoophyte is incrusting and destitute of any axis. In the *Gorgonidæ* there is an internal horny axis. In the three remaining families there is a distinct *rachis* or stem, the zoophytes being more or less pen-shaped. The last-mentioned three families are arranged by Herr Kölliker as follows (*Challenger Reports*, vol. ii., "Pennatulida") :—

#### PENNATULIDA.

Sect. I. *Pennatulæ*. Polyps on leaves.

(a) Leaves well developed.

Family *Pennatulidæ*, genus *Pennatula*.

(b) Leaves small.

Family *Virgularidæ*, genus *Virgularia*.

Sect. II. *Spicatæ*. Polyps sessile.

Family *Funiculinidæ*, genus *Funiculina*.

The family *Alcyonidæ* contains the single genus *Alcyonium*. In this genus the zoophyte is sponge-like, and contains no horny axis or stem. The polyps are scattered over the surface, and are retractile. When withdrawn the zoophyte presents anything but an inviting appearance; being simply a fleshy mass filled with spiculæ, and pitted all over with star-shaped

depressions, showing the places where the eight-rayed polyps have withdrawn.

The spicules of the Alcyonaria are favourite objects with all microscopists. They occur imbedded in the fleshy cœnenchyma, and also in the body wall of the polyps. They are calcareous, and generally assume ragged and intricate forms. They are useful in affording support and giving compactness to the fleshy structure. The polyps are inter-connected by a series of canals which run through the entire system, and are themselves connected with each other by smaller tributary and capillary passages. By this means the zoophyte is nourished throughout, and is generally kept distended with water. The *Gorgonidæ* differ from the *Alcyonidæ* in having an internal flexible horny axis, which is arranged generally in a palmate or fan-like manner, as shown in Plate XV., fig. 5. This axis is covered all over with a fleshy part in which the polyps are placed. The fleshy part is strengthened by calcareous spicules. The horny axis also contains carbonate of lime. The polyps project from the cœnenchyma like small warts, each wart having a star-like depression at the top, through which the polyp is exerted. The axis varies in thickness according to age. It is found in concentric layers, a transverse section having an appearance under the lens not unlike that of an exogenous stem.

The remaining families are united into one sub-order, the *Pennatulida*, or "Sea Pens," the latter being a very appropriate and significant name. Their structure and life-history have received very great attention, Herr Kölliker having written several works upon the subject, and Messrs. Marshall having, in the report above

referred to, exhausted the knowledge on the subject so far as the English species are concerned. In the *Pennatulida* the zoophytes are more or less pen-shaped, having a stalk which is often buried in the mud, surmounted by a *rachis*, upon which, either directly or on leaves, are borne the polyps. The stem is made up of horny and calcareous matter, and is often quadrangular in section, and surmounted throughout by the investing cœnenchyma. The stalk and rachis are traversed by longitudinal canals which are connected with the canals of the cœnenchyma. Amongst all the *Pennatulida* there are not only mature polyps, but immature or rudimentary ones called zooids, the peculiarities of which have been stated. The leading differences between the three families of this type are stated in the table already given, and relate to the arrangement of the polyps.

## BRITISH ALCYONARIA.



## FAMILY I. ALCYONIDÆ.

GENUS ALCYONIUM, *Linnæus*.

*Polyp-mass* lobed or incrusting, spongy, the skin coriaceous, marked with stellated pores. Interior gelatinous, netted with tubular fibres, and perforated with longitudinal canals, terminating in the polyp-cells, which are subcutaneous and scattered. *Polyps* exerted.—JOHNSTON.

1. *A. DIGITATUM*, *Linn.* See Plate XV., fig. 1.

*Lobularia digitata* (*Flem., De B., Grant*), *A. lobulatum* (*Pall., Lamæ.*), *Lobularia digitata* (*Roget*).

*Hab.*: Generally distributed.

This well-known species rejoices in a number of synonyms which are very descriptive of its appearance when drawn from the water. "Cow's Paps," "Dead Man's Fingers," "Dead Man's Toes," are the usual appellations given by fishermen to the species under consideration. The difference between this zoophyte under water with all the polyps extended, and the same object limp and sponge-like on the sand, would hardly be credited. It is generally found of a greyish-white colour, but orange or reddish varieties are occasionally found. It varies in height and shape from a mere incrustation to a large irregularly lobed mass, not at all unlike a large swollen dead hand, attaining in that form a height sometimes of 10 inches.

2. *A. GLOMERATUM*.*A. sanguineum* (*R. Q. C.*).

Hab.: Dublin Bay (*Hassall*), Cornwall (*Couch*), Salt-coats, Cumbries (*D. L.*).

The species is rare, and differs from the preceding in colour, being light red. The spicules are more or less "K" shaped.

## FAMILY II. GORGONIDÆ.

## GENUS GORGONIUM.

*Polyp-mass* rooted, arborescent, consisting of a central horny axis, with a polypiferous crust when living, soft and fleshy, but porous and friable when dried.—*JOHNSTON*.

1. *G. VERRUCOSA*, *Cole*. Plate XV., fig. 5.

*G. viminalis* (*Sowerby*).

Hab.: Plentiful on the South Coast. Height 1 foot by 16 in. broad.

This species has been called the "Sea Fan," the "Sea Fern," and the "Sea Heath." The axis is black and smooth, with a white pith. When alive the crust is fleshy and flesh-coloured, becoming whiter and friable when dried.

Ellis, who found it on the east of Cornwall, states that "the outside of it is covered with a crust, full of little lumps like warts, which, when dissolved in vinegar, discover the contracted bodies of polyps with 8 claws."

In appearance it is stout and fan-shaped.

2. *G. PINNATA*, *Forbes*.

Hab.: Skye (*Forbes*).

"When taken alive it was of a cream-white colour. The polyps are white, with 8 dull white granular

pinnated tentacles. They are very sluggish, and did not expand."

3. *G. PLACOMUS*.

This species is a native of Norway. Ellis describes it as "the Warted Sea Fan," and states that it was found in Cornwall, but as no one else appears to have found it since, it may be considered as a doubtful member of the British Fauna.

4. *G. ANCEPS*, *Dale*.

Hab.: Near Margate (*Dale*).

This, also, is a doubtful British species.

5. *G. FLABELLUM-VENERIS*.

This is one of the best known representatives of the genus; but its claims to be British are doubtful, as, although several localities are given, the specimens found had been, in all probability, thrown overboard from some homeward-bound vessel.

GROUP PENNATULIDA.

FAMILY III. PENNATULIDÆ, KÖLLIKER.

GENUS PENNATULA.

True sea-pens, with well-developed *leaves*, in which there are no zooids, and no very large calcareous rods, but a number of small spicules. *Zooids* situated along the whole ventral surface of the rachis, and also on the lateral surfaces between the leaves. *Polyps* in cups, beset with calcareous spicules. *Calyx* processes variable in number.—KÖLLIKER.

1. *P. PHOSPHOREA*, *Linn.* Plate XV., fig. 3.

*P. rubra*, var. *β.* (*Pall.*), *P. britannica* (*E. and S.*), *P. alba* (*Esper*), *P. rubra* (*D. Chiaje, Ehr.*), *Penna rosea* (*Bohadsch*), *Phosphorella phosphorea* (*Gray*).



Hab.: Coast of England and Hebrides (*Dr. Gray*), Scotch coast (*Ellis*), Oban (*Marshall*), St. Andrews (*McIntosh*), Lamlash Bay (*D. L.*). Height 4—6 in.

This species has been called the "Cock's Comb," the "Sea Pen," and the "Sea Feather." It is of reddish colour, except the lower part of the stalk, which is yellowish, and bent slightly near the point. The colour is derived from the spicules contained. The stalk is nearly one-half of the length of the zoophyte, and is believed to be fixed in the mud at the bottom of the sea. The polyps are "fused together so as to form leaves," and number from 2—15 in each leaf, according to its length. The number of leaves is 34—36 on each side. The zooids are found on the ventral surface of the *rachis*, and between the bases of the leaves.

This species is very phosphorescent, hence its name. The light has been found by *Panceri* to arise solely from special phosphorescent organs—"cordoni luminosi"—placed one in each compartment of the body cavity of the polyps and zooids.

2. *P. RUBRA*, *Ellis*.

*Pennatula italica* (*E. and S.*), *P. setacea* (*Esper*), *P. granulosa* (*Lamk., M. Edw., De Bl.*), *P. phosphorea* (*Cuvier, D. Chiaje*), *Penna rubra* (*Bohadsch*).

Hab.: Bristol Channel (*Gray*).

This species differs from the preceding in having 25—46 polyps in each row, placed alternately so as to appear like two rows. Calyx processes usually three or four to each polyp.

3. *P. PULCHELLA*.

*Phosphorella pulchella* (*Gray*).

Hab.: Shetland (*Laughin*), Polperro (*R. Q. C.*).

This species has 20 broad leaves on each side.

## FAMILY IV. VIRGULARIDÆ.

## GENUS VIRGULARIA.

*Leaves* small, attached to the rachis by wide bases ending below in a series of undeveloped leaves. *Polyp-cells* fused together along the greater part of their length. *Zooids* lateral.—KÖLLIKER.

V. MIRABILIS, *Lamarck*. Plate XV., fig. 4.

V. laxipenna (*De Bl.*), P. mirabilis (*Müller, Pall.*), *Lygus mirabilis* (*Gray, Herklots, Kölliker*), *Scirpearia mirabilis* (*Templeton*).

Hab.: Belfast Lough, Gairloch, Oban, St. Andrews, and elsewhere in Scotland. Height to 14 in.

"Feather two and a half times the length of the stalk, leaves halfmoon-shaped, smooth, placed laterally but slightly obliquely, the ventral border being higher than the dorsal, overlapping one another only slightly or not at all, attached by wide bases. Polyps 6—9 on each leaf, their cavities separated from one another."—(*Kölliker*.)

Sir J. G. Dalzell describes it as "a long fleshy round shell or bone invested by a fleshy covering which expands from each side into a number of lobes, also fleshy, bordered by several asteroidal hydræ."

The stalk of this species appears to be imbedded in the mud, and from the investigations of Darwin and others it is probable that the animal is possessed of strong contractile powers, so as to withdraw itself into the sand or mud out of the way of danger.

This beautiful species is very difficult to obtain un-mutilated; a perfect specimen in every respect not having been obtained or seen by even the most experienced authorities.

## FAMILY V. FUNICULINIDÆ.

## GENUS FUNICULINA.

Long slender sea feather. *Stalk* short. *Polyps* inserted directly into the rachis. *Stem* quadrangular. *Calyx* with 8 processes.—KÖLLIKER.

1. *F. QUADRANGULARIS*, *Herklots*.

*Pennatula quadrangularis* (*Pall.*), *P. antennina* (*Linn., E. and S.*), *P. tetragona* (*Lamk.*), *Pavonaria antennina* (*Cuvier, Schweigger, Ehr.*), *P. quadrangularis* (*De R., D. Chiaje, Forbes, Dana, M. Edw., G. J., D. L.*), *Funiculina antennina* (*Høven*), *F. Forbesii* (*Verrill, Gray*).

*Hab.*: Oban, Raasey Sound, Hebrides, St. Andrews. Height up to 53 in. Feather five to six times as long as the stalk.

In this species the rachis is very long, and is studded with polyps which are not arranged, as in the two preceding families, in leaves, but are individually sessile on the rachis. The colour of the rachis is ivory-white, and of the stalk yellowish-brown.

This is a brilliantly phosphorescent species. Like the preceding species it is believed to live erect with its stalk buried in the mud.

The anatomy of the *Pennatulida*, accompanied by exact and beautiful drawings, is fully given in the report of Messrs. Marshall before referred to, to which the reader is referred for details of microscopic structure.

## THE POLYZOA.

### *Description.*

The Polyzoa are possessed of a much higher degree of organization than the animals already described. Although to the naked eye many of the Polyzoa resemble some forms of Hydroida in appearance, they are found, when examined with the microscope, to be formed on a very different plan. Like the Hydroida each polypide possesses a crown of tentacles, but the functions of these appendages are very different in the two classes. In the Hydroida, as has been pointed out, their functions are tactile; in the Polyzoa they unite to this function that of respiration, serving the purpose of gills, and on this account, as well as on others, the Polyzoa are dealt with by many naturalists as allied to the Mollusca.\*

As their name implies, the Polyzoa exist in colonies, sometimes connected by a creeping stolon, at others closely packed together, and expanding into a broad leaf-like structure. In some species the cells or zoecia are simple and unadorned, in others they are toothed and girt with spines, and in some cases most richly ornamented.

The Polyzoa inhabit both fresh and salt water; but the number of fresh-water species is limited, and with the exception of one genus, *Paludicella*, the fresh-water

\* The position of the Polyzoa in the scale of classification is at present very much disputed, and any position to which the class is assigned can only be considered as tentative.

species are distinguished from the marine species by possessing a valve-like organ (the *epistome*) arching over the mouth. The members of the entire class are fixed, with the exception of *Cristatella*, a fresh-water genus, which is locomotive.

Each animal in a colony of Polyzoa consists of two parts—a zoecium or cell and a polypide—which two parts are vitally connected, the zoecium being not merely an unorganized protection for the polyp, as in the case of the Hydroida, but being itself in organic connection with the polypide. Indeed it is sometimes argued that the zoecium is a permanent organism, and the contained zooid an ephemeral one. This argument is based upon the fact that the zoecium may continue alive after the destruction of the polypide, and may have successive new inmates. Many naturalists, however, consider the zoecium and polypide as forming together one animal or polyzoon.

The general appearance of a polyzoon may be seen from Plate XVI., fig. 1. The zoecium is a membranous sac (*c*), often strengthened by a deposit of calcareous or silicious matter, and lined by the endocyst, which extends over the orifice of the zoecium in order to form a sheath for the tentacles. The zoecium is, therefore, closed by the endocyst except in two places, one the anal orifice, and the other the aperture or orifice through which the tentacles protrude; but as the protrusion of the tentacles is simply like the pulling out of the finger of a glove, there is no real opening out of the zoecium, which is entirely sealed up. The endocyst, or internal lining of the zoecium, forms the sheath of the tentacles (*t*), which are upon a stage called the *lophophore* (*l*). Between the tentacles is the

mouth (*m*) opening into the œsophagus (*œ*), which passes into the stomach (*s*), from which the intestine (*i*) leads to the anal orifice (*a*). The œsophagus, stomach, and intestine, with the tentacular corona, form the polypide, which may be described as suspended by the lophophore in the cavity of the zoœcium. The polypide is kept in its place and regulated by the muscles (*r*) and funiculus (*z*), which will be afterwards described. This description applies to nearly all the Polyzoa, but a few species grouped as Entoprocta have both orifices, the oral and the anal, within the lophophore, and, as has been stated, in the fresh-water Polyzoa (except *Paludicella*) the mouth of each polypide is protected by the *epistome*.

The zoœcium consists of an external part or ectocyst, and an internal lining or endocyst. Connections between the different zoœcia in a colony are kept up by means of openings in the ectocyst called communication plates (Plate XVI., fig. 4). The endocyst is a transparent membrane forming a lining of living protoplasm to the zoœcium. In *Cristatella* the ectocyst is absent, and the endocyst presents the appearance below of a flattened disc resembling the foot of a gasteropod, on which the colony creeps about on the stems of plants, &c. The many and beautiful forms which the zoœcia of the various members of this class assume will be pointed out in the description of the species, the appearance and arrangement of the zoœcia being important elements in classification.

The polypide requires a more detailed description. Commencing with the tentacles, we find them to be hollow, closed at the extremities and opening inwardly into the cavity of the zoœcium. They are borne upon



a circular or crescentic stage, the *lophophore*, in the centre of which opens the mouth. Each tentacle is richly ciliated, and the cilia, which are vibratile, aid in forming currents by which the food is carried into the mouth. The number of the tentacles varies from 8 to 80. In addition to the tactile use of the tentacles, for which from their mobility and their muscular structure they are well adapted, they perform the functions of gills, and act as respiratory organs. On invagination the tentacles are protected by the sheath before referred to, and the protrusion and retraction of this sheath and the tentacles are the only movements of which the polypide is capable. In all the fresh-water genera (except *Paludicella*) the tentacles are surrounded at the base by a delicate cup or *calyx*, which is prolonged more or less on to the back of each tentacle so as to form a series of little triangles connected by a broad base. This festooned appearance is co-extensive with the presence of the epistome. In the fresh-water family *Plumatellidæ*, the margin of the lophophore is extended into two triangular lobes or arms, causing the lophophore to assume a crescentic appearance. This crescentic appearance is not found in any marine species.

The œsophagus leads directly from the mouth to the stomach and is thickly ciliated, and in some species the upper portion forms a funnel-shaped pharynx (Plate XVI., fig. 6 *ph*), which is often dotted with spots. The œsophagus communicates with the stomach by means of the *cardia* (Plate XVI., fig. 2), which is a conical projection so placed as to prevent the return of the food into the œsophagus during the contraction of the stomach in the process of digestion.

The stomach is a bag in which the process of digestion is carried on, and has three layers, the inmost of which consists of cells containing a brown matter, variable in quantity with the supply of food, and is regarded as showing a glandular structure formed for the purpose of secreting bile, and, therefore, identical in function with the liver of higher organisms. The base of the stomach differs in structure from the upper part, and is often observed to separate from the remainder of the stomach by a constriction, whereby it appears to seize upon the different portions of the food in turn, and after a temporary pressure to release them. The intestine opens out of the upper end of the stomach, which is generally prolonged into a wide chamber called the pyloric vestibule, at the upper end of which is the pyloric valve (*p*), which has functions similar to that of the cardia. Before passing into the intestine the food accumulates in the pyloric vestibule, where the whole of the nutritious matter is absorbed, and the rest in the form of pellets is sent through the intestine, and discharged at the anal orifice. In *Bowerbankia* and some other species the upper part of the stomach is occupied by a gizzard (fig. 2 *gi*), the walls of which are very muscular, and provided with a crushing apparatus in the form of pointed projections called gastric teeth.

The intestine is not ciliated.

The nervous system of the Polyzoa is limited to a single ganglion which is found (Plate XVI., fig. 1 *g*) on the side of the œsophagus nearest to the anal orifice. From this ganglion nervous filaments have been traced to the lophophore and tentacles, and to the œsophagus. That side of a polyzoon on which the nervous ganglion



is found is called the *neural* side, that opposite to the ganglion is called the *hæmal* side.

The muscular system of the Polyzoa is complex and extensive. The principal sets of muscles are the retractor muscles and the parietal muscles.

The retractor muscles consist of two fasciculi or bundles of fibres which are inserted at the base of the cell, and spring from the endocyst. These fasciculi pass one on each side of the stomach to the upper part of the œsophagus. On retraction the fibres of the fasciculi separate and lie loosely in the cavity of the zoecium, and by their retraction they pull down the alimentary canal, and consequently the tentacles, and cause the latter to be invaginated and withdrawn below the orifice of the cell. Around the invaginated sheath is a set of fibres called the vaginal sphincter, which closes the endocyst after the retraction of the polypide.

The parietal muscles consist of short fibres running transversely in the endocyst in small groups of two or three fibres each, occupying a very large portion of the circumference of the cell. These muscles contract the endocyst, which presses upon the fluid contained in the cavity of the zoecium. The result of this pressure and the accompanying relaxation of the vaginal sphincter is to force out the tentacular corona and sheath. The action of the muscles before described is further assisted by two sets of muscles, one behind the other, placed on the inner surface of the endocyst in the neighbourhood of the sheath. These are called the anterior and posterior parieto-vaginal muscles. In addition to the muscles named are those which serve to expand, rotate, and move the tentacles, and to raise

and depress the epistome in the *Phylactolæmata*, and those which are scattered about the various portions of the polypide to aid in the processes of digestion. The cavity of the zoecium, in which the alimentary canal is suspended, is called the perigastric cavity. This is always filled with fluid, in which float a number of particles which have been detached from the cells of the endosarc, and into which the spermatozoa are discharged. In this cavity the reproductive organs are lodged, and the ova pass through their stages into the larval forms. The fluid of the perigastric cavity appears to consist of water and the products of digestion, the latter evidently transuding through the walls of the stomach. The tentacles being hollow, this fluid circulates into them, and is there aerated, this process being analogous to the aeration of the blood of higher animals, to which the fluid with its contained corpuscles or particles bears no slight resemblance.

Connecting the base of the stomach with the endocyst of the zoecium is a contractile cord called the funiculus, which plays a very important part in the economy of the animal. The funiculus extends some distance along the wall of the stomach, and gives off processes which reach to the side of the zoecium. The funiculus consists of elongated cells pointed at both ends, and resembling in shape the frustules of *Navicula*. It extends through the base of the zoecium into the one adjoining it, and so forms a connection between the zoecia of a colony. This funiculus is sometimes called the endosarc. It has been considered by Müller that the funiculus was a "colonial nervous system;" but this view is not generally accepted. It is found in both marine and fresh-water species, and

in all cases the spermatozoa and ova are developed upon it. Budding also, or the growth of a colony by gemmation, proceeds from the endosarc.

The function of the funiculus would therefore appear to be reproductive and not nervous.

In many species of the *Cheilostomata* the zoecia are protected by *avicularia* or "bird's-head processes," and in a few species by *vibracula* or "bristles."

The avicularia differ in shape very much, varying from slightly differentiated zoecia to elaborate structures like those of the *Bugulæ* (Plate XVI., fig. 7). This structure is one which—viewed in any one species without consideration of others—would cause considerable difficulty in deciding as to its nature, but when the avicularia are considered as they occur throughout the *Cheilostomata*, it is found that a development of form can be clearly traced, which shows that the avicularia were originally modified ordinary zoecia, and that, through a multitude of gradations, they have passed in some species into highly specialized organs. Mr. Hincks has very elaborately advocated this view in his "British Marine Polyzoa," and in the *Annals and Mag. of Nat. History*, vol. ix. page 20.

The avicularia are supplied with muscles to regulate their movements, and in some of them is found a cellular body, considered by Mr. Hincks and others to be the analogue of the polypide. It is often armed with bristles, and, therefore, probably serves for tactile purposes.

The use of these curious structures is much questioned. Some have regarded them as food providers, and they have been observed to hold small worms, &c.; but as they are not always placed in positions where

they can be serviceable for this purpose, and as in no case can they transfer any captured food to the mouth, they are probably defensive in their functions, and by their appearance and movements ward off intruders from the colony.

The vibraculum is a long movable bristle which probably serves a similar purpose to that of the avicularium, as it is generally placed where it can move backwards and forwards before the orifice of the zoecium.

Reproduction in the Polyzoa is of two kinds—asexual, for the development of the colony, and sexual. In the latter case the ova, which are contained in the ovary, are fertilized by the spermatozoa, and develop in the body cavity into free ciliated larvæ often beautifully coloured. In many species the ova after fertilization are conveyed to an ovicel or oecium which is developed by budding from the zoecium, with which it is in direct communication, and which serves, according to Professor Huxley, for a marsupial chamber. These ovicels are often very prominent and attractively sculptured parts of the colony. Where the reproduction is asexual, that is by gemmation or budding, the buds, as before stated, are developed from the endosarc.

Amongst the fresh-water Polyzoa there is a curious method of reproduction by statoblasts or “winter eggs,” which are spherical bodies covered with network, and sometimes armed with spines round the circumference. They are regarded as free buds or stationary germs, and not as ova. They are not hatched in the colony, and are evidently intended as “reserves of generative force,” to preserve the repro-

ductive capacity of the colony in case of injury, or upon the disintegration of the cells in which they are contained.

In consequence of the respiratory functions of the tentacles, and for other reasons, most naturalists, especially English ones, consider the Polyzoa as belonging to the sub-kingdom Mollusca, or to a branch of that sub-kingdom called the Molluscoida.\* Continental zoologists apply the term "*Bryozoa*" to these animals. This term was first used by Ehrenberg in 1831, but as the term "Polyzoa" had been used in Thomson's researches in 1830, the latter clearly has priority, and is universally used in England.

#### CLASSIFICATION OF THE BRITISH POLYZOA.

The POLYZOA are a class of the division MOLLUSCOIDA of the sub-kingdom MOLLUSCA.\* They are classified as follows:—

Sub-class I. **Holobranchia.** (Tentacles in an unbroken series.)

Group *a.* **Ectoprocta.** (Anal orifice outside the lophophore.)

Order I. GYMNOLÆMATA. (Polypide destitute of an epistome.)

Sub-order I. CHEILOSTOMATA. (Zooecium closed by an operculum.)

Families. *Æteidæ*, *Eucratidæ*, *Cellularidæ*, *Bicellaridæ*, *Notamidæ*, *Cellaridæ*, *Flustridæ*, *Membraniporidæ*, *Microporidæ*, *Cribrilinidæ*, *Microporellidæ*, *Porinidæ*, *Myrizozoidæ*, *Escharidæ*, *Celleporidæ*.

\* See note on page 201.

Sub-order II. CYCLOSTOMATA. (Zoecium inoperculate.)

Families. *Crisidæ*, *Tubuliporidæ*, *Horneridæ*, *Lichen-sporidæ*.

Sub-order III. CTENOSTOMATA. (Zoecium not calcareous, orifice closed by setæ.)

Families. *Alcyonididæ*, *Arachnididæ*, *Flustrellidæ*, *Vesicularidæ*, *Buskidæ*, *Cylindrecidæ*, *Triticellidæ*, *Valkeridæ*, *Mimosellidæ*, *Victorellidæ*.

Sub-order IV. PALUDICELLEA. (A fresh-water form.)

Family. *Paludicellidæ*.

Order II. PHYLACTOLÆMATA. (Polypides possessed of an epistome.)

Families. *Cristatellidæ*, *Plumatellidæ*.

Group b. Entoprocta. (Anal orifice within the lophophore.)

Order. PEDICELLINEA.

Families. *Pedicellinidæ*, *Loxosomidæ*.

Sub-class II. Pterobranchia. (Tentacles in discontinuous series.)

Order. PODOSTOMATA.

Family. *Rhabdopleuridæ*.



## BRITISH POLYZOA.

## Order GYMNOLÆMATA.

## SUB-ORDER I.: CHEILOSTOMATA, BUSK.

FAMILY I. AETEIDÆ. (*Aetea*, mistake for *Actea*,  
a Nereid.)

*Zoœcia tubular, with a lateral membranous area, orifice terminal. Tentacular sheath terminating above in a circle of setæ everted during expansion of polypide.*  
—T. H.

## GENUS I. AETEA.

*Zoœcia* calcareous, erect, distributed among a more or less creeping fibre dilated at intervals. No *Oœcia*.  
—T. H.

## 1. A. ANGUINA, Linnæus. Plate XVII. fig. 1.

Anguinaire serpent (*De B.*), *Sertularia anguina* (*Linn., Turt., Berk., Stew.*), *Cellularia anguina* (*Pall., Ellis, Hogg*), *Cellaria anguina* (*E. and S., Bosc.*), *Falcaria anguina* (*Oken*), *Sertularia mollis* (*D. Chiaje*), *Anguinaria anguina* (*Flem., List.*), *Anguinaria spatulata* (*Lamk., Busk, Stark, Temp., P. H. G., G. J., D. L., R. Q. C.*).

Hab.: Very abundant, especially in the South and West of England.

This is the "Snake Coralline" of Ellis (*Cor.*, 43),

and is found covering the fronds of seaweed with its profuse growth. To the naked eye only apparent as small white streaks or hairs, this zoophyte presents under the microscope a very unique and beautiful appearance. It seems as if a crowd of fairy snakes had made the seaweed their home, and were lifting up their heads in every direction. Each cell springs from an enlargement in a creeping fibre or stolon. "From very small holes in the broadest part of this irregular winding tube there arise here and there small testaceous white hollow figures, exactly resembling a snake without the lower jaw, in the place whereof is the entrance into the cell" (Ellis). The zoœcia are ringed, and of a clear white colour. The aperture is covered with a membrane, so that the snake-like head and membrane-covered aperture beneath are not unlike a "pelican's beak" (Busk) or a spoon, from which latter resemblance arose the specific name *spatulata*, often applied to the species. The top of the cell or "head" is marked with dots. The membranous sheath is surrounded by "a delicate fringe or frill of filmy rays united by a vandyked membrane. The interior contains many very slender threads constantly waving with a vermicular motion" (Gosse, D. C., 143). These "threads" are the setæ referred to in the description of the family characteristics. Dr. Johnston states that they are of a pale pink or flesh colour, or white; but the latter colour is certainly the most widely distributed.

2. A. RECTA, *Hincks*.

*Hippothoa sica* (R. Q. C., D. L., G. J.), *Stomatopora Gallica* (D'Orb.), *Ætea sica* (Couch).

Hab.: Torbay, Salcombe, Isle of Man, Lamlash,



Arran (*Hincks*), Guernsey, Antrim, Shetland (*A. M. Norman*).

This species is larger than the preceding, and is distinguished by the absence of the snake-like head; the zoecia being straight and erect.

3. *A. TRUNCATA*, *Landsborough*.

*Anguinaria truncata* (*D. L.*), *Salpingia Hassallii* (*Coppin, McA.*).

Hab.: Lamlash Bay (*D. L.*), Isle of Man, Ilfracombe (*T. H.*).

Zoecia straight, with truncated extremity. Cells usually simple, but occasionally arranged in a series, as in *Eucratea*. A short tube-like process springs from the back of each cell.

Dr. Landsborough seems to have felt the true naturalist's glow of pleasure at the discovery of this species, which he first saw when "he had the pleasure of a day's dredging in Lamlash Bay with Prof. Balfour and other friends. He observed that a large frond of *Laminaria* was roughened with little bristles. On reaching home he found that the little bristling tubes which had attracted his attention, were not distinct polypidoms, but little tubular pores springing from a fistular fibre which ran in an irregular line along the frond. The upright pores were like a small quill cut across, and then a longitudinal slice cut off towards the top, as in the first step in the process of making the quill a writing pen" (*Pop. Hist. of B. Z.*, 288).

A peculiarity of this species is, that many of the cells have an appendage, like a long tube, springing from the back of them, called the "dorsal tube."

## FAMILY II. EUCRATIDÆ.

*Zoecia uniserial or in two series placed back to back, expanding from the base upwards with a terminal or subterminal and usually oblique aperture. Zoaria forming slender branching phytoid tufts.*—T. H.

## GENUS I. EUCRATEA, Lamourouz.

From *Eucrate*, one of the Nereids.

*Zoarium* composed of a creeping base and erect branching shoots. *Zoecia* subcalcareous, uniserial. *Aperture* large, oblique, lateral or sublateral, the oral opening at the top of it. *Oecia* terminal. *Tentacular sheath* terminating in a ring of setæ.—T. H.

1. *E. CHELATA*, Linn. Plate XVII. fig. 2.

? *Hippothoa cassiterides* (R. Q. C., D. L., G. J.), *Crisia chelata* (G. J., R. Q. C.), *Sertularia chelata* (Linn.), *Cellularia chelata* (Pall.), *Sertularia loricata* (Linn., Turt., Stew.), *Cellaria chelata* (E. and S., Lamk.), *Scruparia chelata* (Oken, Busk, P. H. G., McA.), *E. loricata* (Flem.), *Unicellaire cornet* (De B.), *Eucratée cornée* (M. Edw.), *Catenaria chelata* (D'Orb.).

Hab.: Widely distributed.

In this species the zoecia are white, shining, and perfectly transparent. They are shaped like a bull's horn, hence the name "Bull's-Horn Coralline," given by Ellis ("Corallines," 42). A "powder-horn would be a better comparison" (Gosse), or a shoe (Couch), or slipper (Landsborough).

Mr. Gosse's description of this species is very complete and interesting (D. C., 132). "The outline of the cell is nearly half a crescent. The aperture is large, oval, oblique, and surrounded by a high rim. This is

covered with an elastic membrane. The actual orifice for the emission of the animal is at the upper and outer part of this membrane where the integuments are protruded by gradual evolution, according to the universal rule in this class of zoophytes, in three successive stages, which resemble, when fully protruded, the slides of a telescope. The first of these is horny, and has a sort of spine in the inner margin; the second, of about the same length, is of the most delicate filmy transparency, and has its margin surrounded by a sort of scalloped frill, composed of short ribs (setæ), united by a waved membrane, and diverging at right angles. From this projects the third, which generally bulges more or less at the back or outer side, where the orifice of the rectum is situate. A bell of twelve ciliated tentacles, nearly as long as the interior of the cell, crowns this last evolution."

There is often a rudimentary cell in front of the raised margin of the zoæcium, hence the name *chelata*.

Mr. Hincks describes the polypide as remarkable amongst an active tribe for the vivacity of its movements.

The oœcia are borne on imperfect cells, and are not numerous.

Though occasionally occurring in considerable quantities, it is generally found straggling, thread-like, over other zoophytes.

#### GENUS II. GEMELLARIA, Savigny. (*Gemellus*, double.)

*Zoaria* erect. *Zoœcia* joined back to back. The cells composing the pairs rising one from the top of the other, all the pairs facing one way. *Aperture* large on the front of the cell, oblique. No *Oœcia*.—T. H.

*G. LORICATA*, *Linnaeus*. Plate XVII. fig. 3.

*Sertularia loricata* (*Linn.*, *Turt.*, *Berk.*, *Stew.*), *S. loriculata* (*Linn.*), *Cellularia loriculata* (*Pall.*, *Dal.*, *Hogg*), *Cellaria loriculata* (*E. and S.*, *G. J.*), *Scruparia loricata* (*Oken*), *Crisia loriculata* (*Lamæ.*), *Loricaria Europea* (*Lamæ.*), *Notamia loriculata* (*Flem.*, *Farre*, *G. J.*, *R. Q. C.*), *Loricula loricata* (*Cuvier*), *Gemicellaria loriculata* (*De B.*), *Gemellaria loriculata* (*Van Ben.*, *G. J.*, *Ald.*, *D. L.*), *G. Willisii* (*Dawson*).

*Hab.*: Very generally distributed, especially plentiful on Sutherlandshire, St. Andrews, Northumberland, and Lancashire coasts.

This easily distinguishable species is noticeable from the bushy appearance of the tufts which it forms in its regular mode of growth. The cells are arranged in pairs placed back to back, each pair resembling somewhat a coat of mail, the apertures representing the armholes. From this appearance the species was named the "Coat of Mail Zoophyte" by Ellis (*Cor.*, 40), who says, "each pair resembles a coat of mail or pair of stays."

The colour is yellowish-brown, and the zoaria attain a height of from 2—5 inches, and even more.

There appears to be considerable variation in the texture and shade of colour, some species being very coarse and dark coloured, and others being almost silky and nearly white.

### GENUS III. *SCRUPARIA*, *Hincks*.

*Zoaria* erect, branches given off from the back of a cell, and facing in the opposite direction. *Zoæcia* subcalcareous, rising one from the other, so as to form a single series, or placed back to back. *Aperture*

small, terminal. *Ovicelligulous cells* small and imperfectly developed. *Oœcia* terminal.—T. H.

1. *S. CLAVATA*, *Hincks*.

*Hab.*: Lamash Bay, Arran, Filey Bay (*Hincks*).

*Zoœcia* uniserial, or biserial and dorsally adnate. "Each cell is attached to the dorsal surface of the one next below it by a heart-shaped expansion of the base."

This species, which is parasitic on other Polyzoas, was discovered by Mr. Hincks, and described by him in the "Quarterly Journal of Microscopic Science," vol. v. 175. Its mode of growth is liable to considerable variations, the *zoœcia* being sometimes uniserial and sometimes biserial.

#### GENUS IV. *HUXLEYA*, *Dyster*.

Named in honour of Professor Huxley.

*Zoarium* corneous or subcalcareous, dichotomously branched, the branches given off from the top or side of a cell, and facing in the same direction. *Zoœcia* uniserial.—T. H.

*H. FRAGILIS*, *Dyster*.

*Hab.*: Tenby (*Dyster*).

Discovered by Dyster, and described in the Q. J. M. S., vi. 260.

The *zoœcia* are white and flexible, uniserial, and extend to a height of  $\frac{1}{2}$ —1 inch. Each cell rises from the top of the one beneath it, and is elongated with a rounded top, and a small semicircular aperture. The margin has no spines.

#### GENUS V. *BRETTIA*, *Dyster*.

Named after Mrs. Brett.

*Zoarium* erect, corneous, branched. *Branches* given

off from the top of a cell a little to one side, and facing in the same direction as the cell. *Zoecia* uniserial, elongate, tubular. *Aperture* terminal or subterminal, with oral valve at extremity, margin armed with spines.—T. H.

1. *B. PELLUCIDA*, *Dyster*.

Hab.: Tenby (*Dyster*, *Mrs. Brett*).

Described by *Dyster* in *Q. J. M. S.*, vi. 260.

2. *B. TUBÆFORMIS*.

*B. pellucida* (*A. M. N.*).

Hab.: South-east Coast (*Boswell*), Hebrides (*Norman*).

Described by *Rev. A. M. Norman* in *British Assoc. Report*, 1866, 196.

These two species are rare, and have been described from fragmentary specimens.

### FAMILY III. CELLULARIDÆ.

*Zoecia* in two or more series, closely united and ranged in the same plane. *Avicularia* and *vibracula*, or *avicularia* only, almost universally present, sessile. *Zoarium* erect, dichotomously branched.—T. H.

GENUS I. CELLULARIA, *Pallas*. (*Cellula*, a little cell.)

*Zoarium* jointed. *Zoecia* in two or three series, many in each internode, contiguous, dorsal surface perforated. *Avicularia* and *vibracula* usually wanting, the former occasionally present on a few cells in an internode.—T. H.

*C. PEACHII*, *Busk*.

? *C. neritina* (var. *G. J.*), *Bugula neritina* (vars. *b*, *c*, *d*, *e*, *Gray*).

Hab.: Peterhead (*C. W. P.*), Buchanness, Tynemouth (*Lieut. Thomas*, *R. N.*), Northumberland (*Ald.*), Shet-



land (A. M. N.), Scarborough (Bean), Aberdeen (Dawson).

Zoaria forming slender tufts; cells white, and arranged alternately in a double row. At the upper and outer angle of each cell is generally present a minute upright spine. Each cell slopes towards the outside, and is surrounded by a thickened margin. There is also a row of small openings at the back of the cell towards the outer border. There are rarely any avicularia or vibracula.

GENUS II. MENIPIA, Lamouroux.

After *Menipea*, one of the Nereids.

*Zoecium* oblong, widest above, attenuated and often elongated downwards, imperforate behind with a sessile *avicularium* (often wanting), and usually one or two *avicularia* on the front of the cell. No *vibracula*. *Zoarium* jointed.—T. H.

1. M. TERNATA, E. and S. Plate XVII. fig. 4.

*Sertularia ternata* (Turt.), *Cellaria ternata* (E. and S.), *Crisia ternata* (Lamx., G. J.), *Tricellaria ternata* (Flem., Gray, De B.), *Cellularia ternata* (Smitt, G. J., D. L.), *Cellarina gracilis* (Van Ben.).

Hab.: Sent from Aberdeen by Dr. D. Skene to Ellis. Scarborough (Bean), Filey (T. H.), Northumberland (Ald.), Peterhead (C. W. P.), Shetland (A. M. N.).

Zoophyte bushy, white, three cells to an internode. *Zoecia* elongated, with large lateral *avicularia*.

This species sometimes grows to the height of about an inch, but is usually smaller. It is found on Algæ and Hydroids, along the stems of which it climbs. The first description of it is contained in Ellis and Solander ("Corallines," 30). It is there described under the

name of "the three-celled celluliferous Coralline," as "of a stony, semi-transparent nature, jointed, and creeping. The joints are nearly top-shaped, with angles (the avicularia) at their sides. They have three cells in the front of each." The cells are armed with three short spines, two at the top and one a little below. From some of the branches arise long tendrils, with open extremities.

2. M. JEFFREYSII, *Norman*.

Hab.: Shetland (*Peach*).

Described and figured from fragmentary specimens by Rev. A. M. Norman in the Q. J. M. S., 1868 (N. S.), viii. 213.

There are 4—7 cells to an internode, and each cell has a prominent avicularium below the aperture.

GENUS III. SCRUPOCELLARIA, *Van Beneden*. (*Scrupus*, a stone, and *cella*, a cell.)

*Zoarium* jointed. *Zoecia* numerous in each internode, rhomboid. *Aperture* with or without an operculum. A sessile *avicularium* placed laterally at the upper and outer angle, and a *vibraculum* in a bend or sinus in the lower part of the dorsal surface. Frequently an *avicularium* on the front of the cell.—T. H.

*Without an operculum.*

1. S. SCRUPOSA, *Linn.*

*Sertularia scruposa* (*Linn.*), *Cellularia scruposa* (*Pall., Flem., Reid, Smitt, G. J., D. L., R. Q. C.*), *Cellaria scruposa* (*E. and S., Lamk., G. J., Bosc*), *Scruparia scruposa* (*Oken*), *Bicellularia scruposa* (*De B.*), *B. raboteuse* (*De B.*).

Hab.: Generally distributed.

This is the "Creeping Stony Coralline" of Ellis



(Corall., 38). He describes it as "of a stony, brittle texture, and having angular sides to its cells." From the latter feature it is called by Dr. Solander the "Stony Angular-celled Coralline." Each cell is armed with two spines at the top, a large avicularium at the side, and a vibracular cell. The zoophyte forms bushy tufts of a white colour.

2. *S. ELLIPTICA*, *Reuss*.

*S. inermis* (*A. M. N.*).

Hab.: The Minch, Hebrides (*A. M. N.*), Shetland (*C. W. P.*).

Described and figured by the Rev. A. M. Norman in the *Q. J. M. S.*, 1868 (*N. S.*), viii. 215. He describes it as more robust than *S. scruposa*, and as being without spines. In colour the zoophyte is yellowish.

*With an operculum.*

3. *S. SCRUPEA*, *Busk*.

Hab.: Dartmouth (*Forbes*), St. Ives, Torbay, Guernsey (*T. H.*), the Minch (*A. M. N.*).

This species was described by Mr. Busk in the *Annals of Nat. Hist.*, ser. 2, vii. 83.

It grows to a height of  $\frac{3}{4}$  inch, and to the naked eye resembles *S. scruposa*. Each cell is armed with three spines on its outer margin above, and one or more on the inner margin. The operculum is rounded below, pointed at the top, with a lateral projection. There are large lateral avicularia and vibracular cells.

4. *S. SCABRA*, *Van Ben*.

*Sertularia halecina* (*Fabr.*), *Flustra scruposa* (*Fabr.*), *Cellarina scabra* (*Van Ben.*), *Cellularia scruposa* (*Ald.*), *Sertularia scruposa* (*Busk*), *S. Delilii* (*Busk, Ald.*), *Cellularia scabra* (*Smitt*).

Hab.: Northumberland and Durham Coasts.

This species greatly resembles the preceding. It grows to a height of  $\frac{1}{2}$  inch. The operculum is triangular in shape, with the angles somewhat rounded, and is ornamented with a vandyked, fan-shaped pattern.

Each cell is surmounted by a spine. The oœcia are ornamented with radiating lines.

5. *S. REPTANS*, Linn. Plate XVII. fig. 5.

*Sertularia reptans* (Linn., Fabr., Turt., Stew.), *S. repens* (Berkenhout), *Cellularia reptans* (Pall., Reid, Smitt, Flem., Dal., G. J., P. H. G., D. L., R. Q. C.), *Cellaria reptans* (E. and S., Lamk., Stark), *Scruparia reptans* (Oken), *Crisia reptans* (Lamx., Temp.), *Acamarchis Geoffroyi* (Andouin, Savigny), *Bicellularia reptans* (De B.), *Canda reptans* (Gray, Busk, McA.), *Bicellaire rampante* (De B.).

Hab.: Common, on stones, shells, and other zoophytes.

This is the "Creeping Coralline" of Ellis (Corall., 37). The cells are oval, with three spines on the outer margin. There is a small avicularium behind the spines. The operculum is very curious, being well described by Mr. Hincks as "antler-shaped." The colour is light grey, occasionally tinged with red. The oœcia are globose and ornamented with punctures. The zoarium is attached to the object upon which it grows by tubular roots, some of which, as Ellis found out, are "full of hooks the better to secure it when it adheres to soft spongy substances."

At the points of division of the branches are tubular processes serving as hinges to prevent strain upon the zoarium by the motion of the waves, &c.

"When this zoophyte is put into vinegar, a strong

effervescence ensues, till the stony or coral-like coat is destroyed; and then the cells, still keeping their shape, appear to be made of a thin pliable membrane like those of the hinges and roots; so that roots, hinges, and cells appear now to be one continuous tubular membrane, only modified into different shapes."—*Ellis*.

This is one of the most easily identified species, the peculiar-shaped operculum being most prominent, and the entire zoophyte being interesting and beautiful.

#### GENUS IV. CABEREA, *Lamouroux*.

From *Caberea*, the daughter of Proteus.

*Zoarium* not articulated. *Zoecia* in two or more series, subquadrangular or ovate, with a very large aperture. Sessile *avicularia* on the side and front of the cells, the lateral *avicularium* minute. *Vibracular* cells very large, placed in two rows, stretching obliquely downwards across the back of the *zoecia*, which they almost cover, to the median line, notched above and traversed through a great portion of their length by a shallow groove. *Setæ* usually toothed on one side.—*T. H.*

##### 1. C. ELLISII, *Fleming*.

Flustra *Ellisii* (*Flem.*), *F. setacea* (*Flem., G. J., D. L., De B.*), *Cellularia Hookeri* (*G. J., D. L.*), *Bicellaria Hookeri* (*De B.*), *C. Hookeri* (*Busk, P. H. G., McA.*), *Flabellaria setacea* (*Gray*).

Hab.: In deep water in Shetland, the Minch (*A. M. N.*), Torquay (*Hooker*).

This species grows to the height of 1 inch, and is fan-shaped and yellowish-brown. It appears to be rare, except in the Shetland Seas, in which Norman says it is one of the more common Polyzoa. Dr.

Fleming says that the "branches are straight, stiff, and brittle, the cells are protuberant dorsally, and their rounded top is nearly free, projecting laterally, giving the edge a remarkably jagged outline; and the pearly ovaria are rounded." A prominent feature is the curious vibraculum, which is long and toothed, and springs from a large grooved vibracular cell. This species possesses avicularia, and each cell is armed with three spines on the upper margin.

2. *C. Boryi*, *Audouin*.

*Crisia Boryi* (*Audouin*), *Cellularia Hookeri* (*Flem.*), *Selbia zelanica* (*Gray*), *Caberea zelanica* (*Busk*).

Hab.: Torquay (*Hooker*), Herm, Budleigh-Salterton (*Hincks*), Channel Islands (*A. M. N.*). "Essentially a southern form."

This species is much smaller than the preceding, the height being about  $\frac{1}{4}$  inch. The vibracula are long and serrated, and each cell has a somewhat oval operculum.

The Rev. A. M. Norman states that if the habitats given by various authors are correct, the range of this species is most extraordinary. No other Polyzoa—probably *very* few marine animals—have so extensive a distribution.

#### FAMILY IV. BICELLARIDÆ.

*Zoæcia* rather loosely united in two or more series, or disjunct; obconic, or boat-shaped, the aperture usually occupying a large proportion of the front. Avicularia, when present, capitate, pedunculate, and jointed. Zoarium not articulated, erect and phytoid, or composed of a number of cells connected by tubular processes.—T. H.

GENUS I. BICELLARIA, *Blainville*. (*Bis*, twice, and *cella*, a cell.)

*Zoarium* erect, phytoid. *Zoecia* turbinate, or in the form of a cornucopia, loosely united, more or less free above. *Aperture* looking more or less upward, directed obliquely inwards below; inferior portion of the cells subtubular usually, much produced. *Avicularia*, when present, jointed and capitate. No *vibracula*.—T. H.

1. B. CILIATA, *Linn.* Plate XVII. fig. 6.

*Sertularia ciliata* (*Linn.*, *Berk.*, *Turt.*), *Cellularia ciliata* (*Pall.*, *Dal.*, *Flem.*, *D'Orb.*, *G. J.*, *D. L.*, *P. H. G.*, *R. Q. C.*), *Cellaria ciliata* (*E. and S.*, *Lamk.*), *Bugula ciliata* (*Oken*), *Crisia ciliata* (*Lamx.*, *Temp.*, *Van Ben.*).

Hab.: Cornwall, South Devon, Filey, Fleetwood, Menai Straits (*T. H.*), St. Andrews (*McI.*), Sutherlandshire (*C. W. P.*), Durham Coast (*Hogg*), Bangor, Southport (*A. S. P.*), Ilfracombe (*P. H. G.*).

Ellis (*Corall.*, 38) names this species "the Ciliated Coralline." It is a beautiful zoophyte of a pellucid white colour, forming delicate tufts from  $\frac{1}{2}$ —1 inch in height. On the upper part of each cell are 4 to 7 long calcareous spines, which are easily detached when dry, and one similar spine on the lower margin. Ellis describes the spines as being like eyelashes. Their bases are narrow, and seem to be jointed.

Mr. Gosse (*D. C.*, 144, plate vii.) describes and figures this under the name *Cellularia ciliata*. He describes the cells as "like a wineglass in form, with the rim oblique. The spines are affixed by a joint to a tubercle in the rim, and are four or five times as long as the cells. The polyps have 12 tentacles." This species also possesses avicularia, which are small and have toothed beaks. "The motions of this strange

appendage are in keeping with its curious structure. The whole head ordinarily sways to and fro upon the slender joint at the poll, at intervals of a few seconds; but besides this motion, which is even, though rather quick, the lower mandible, which commonly gapes to its utmost extent, now and then, at irregular intervals, closes with a strong sudden snap, much like the snapping of a turtle's jaws, and presently opens again and leisurely resumes its former expansion."

2. *B. ALDERI*, *Busk*.

*B. unispinosa* (*Sars*).

Hab.: Shetland, Hebrides (*A. M. N.*).

This species is white in colour, and branches dichotomously. It is considered by Mr. Hincks to be a transition species between the uniserial and biserial forms, as the zoëcia, although side by side, are not united throughout their whole length. Each cell is armed with a single long curved spine. "The ovicells remind one in their form of the flower of the calceolaria, to the form of which they bear a close resemblance."—*Norman*.

## GENUS II. BUGULA, *Oken*.

*Zoarium* erect, phytoid. *Zoëcia* boat-shaped, or subquadrangular, elongate, united in two or more series. *Aperture* occupying a large proportion (occasionally the whole) of the front, not turned upwards or oblique. *Avicularia* in the form of a bird's head, pedunculate and jointed, usually one in each cell.—*T. H.*

1. *B. AVICULARIA*, *Linn.* Plate XVIII. fig. 1.

*Sertularia avicularia* (*Linn.*, *Turt.*, *Berk.*), *Cellaria avicularia* (*E. and S.*, *Lamk.*, *G. J.*), *Crisia avicularia*



(*Lamæ.*, *Temp.*), *Cellularia avicularia* (*G. J.*, *D. L.*, *R. Q. C.*), *C. avicularis* (*Reid*, *Dal.*), *Ornithopora avicularia* (*D'Orb.*).

Hab.: Hebrides, Shetland (*A. M. N.*), Peterhead (*C. W. P.*), South Devon (*T. H.*), Cornwall (*R. Q. C.*), Seascale and Blackpool (*A. S. P.*).

This species is often confounded with the succeeding one, and both are named by Ellis the "Bird's Head Coralline." His description and plate xx. aA, apply to this species, and his figures G, H, on plate xxxviii. apply to *B. turbinata*. Ellis was greatly puzzled by the avicularium. He says: "On the outside of each cell we discover, by the microscope, the appearance of a bird's head with a crooked beak, opening very wide; the use of which is as yet unknown to us, not having yet seen this species in its proper element."

Each cell has three spines; two at the upper outer angle, and one on the inner upper angle. The avicularia are large, and placed midway on the outside of each cell. The branches of this and the succeeding species are fan-shaped (*flabellate*). In colour the zoophyte is orange-brown when living, and almost white when dried.

2. *B. TURBINATA*, *Alder*. Plate XVIII. fig. 2.

*Cellularia avicularia* (*Pall.*, *P. H. G.*).

Hab.: Ilfracombe (*P. H. G.*), Herm, Guernsey (*Ald.*), Tenby (*Dyster*), Llandudno, Isle of Man, South Devon (*Hincks*), Menai Straits (*A. S. P.*).

This species is larger than the preceding, growing to 2 inches in height. It grows in flabellate branches, spirally arranged round the central stem, so as to look like a series of funnels placed inside each other. The colour, when living, is orange, becoming paler

when dried. Each cell has a single spine at each of its upper angles. The cells are arranged in 2—6 series, and are rectangular, with an orifice extending over almost the entire front. The avicularia are large and rounded, and placed on the outer side of the cells near the top. The oöcia are globose, with a “hyaline border round the orifice.”

Mr. Gosse's description of *Cellularia avicularia* (D. C., 195) applies to this species. He points out as a curious feature of the avicularia, that they continue their motions after the death of all the polypides in the zoöcia. He describes the funnel-shaped spiral growth of the zoarium as arising from fan-shaped branches, so arranged as to be seen, on turning the whole round, to compose one corkscrew band of fans. Mr. Gosse gives a very full and interesting description of the entire structure of this zoophyte.

3. B. FLABELLATA, *Thompson*. Plate XVIII. fig. 3.

*Flustra avicularis* (*Sowerby, Flem., G. J., Lamx., De B., D. L., R. Q. C.*), *F. angustiloba* (*Lamk.*), *F. capitata* (*Hogg*), *Ornithoporina avicularia* (*D'Orb.*), *Avicella avicularia* (*Van Ben.*), *Avicularia flabellata* (*Thompson, Gray*).

Hab.: St. Andrew's (*McI.*), Northumberland (*Ald.*), Peterhead (*C. W. P.*), Filey, Isle of Man, South Devon (*T. H.*), Menai Straits (*A. S. P.*).

The species is figured by Ellis as a variety of the Bird's Head Coralline (*Cor.*, plate xxxviii. fig. 7).

The branches are fan-shaped, and the zoöcia are placed side by side in broad strap-shaped rows from 4—7 zoöcia in breadth. The cells are oblong, and armed with two spines at each upper angle; one spine being generally longer than the other. The colour is



"delicate flesh colour" when alive, and ashy when dried. The zoophyte is about an inch in height.

4. *B. CALATHUS*, *Norman*.

Hab.: Herm (*A. M. N.*), South Devon Coast (*T. H.*).

This species much resembles the preceding, but differs in colour, retaining its yellowish-horn colour even when dried. The cells are arranged in about 6—8 rows, and there are two *equal* spines at each upper angle. The zoophyte is not so flabellate as the preceding, as it "always takes the form of an elegant simple cup."

Described by Norman in *Q. J. M. S. (N. S.)*, viii. 218.

5. *B. PLUMOSA*, *Pallas*. Plate XVIII. fig. 4.

*Acamarchis plumosa* (*G. J.*), *Cellularia plumosa* (*Pall.*, *R. Q. C.*, *D. L.*), *Cellaria plumosa* (*E. and S.*, *Bosc*, *Lamk.*), *Crisia plumosa* (*Lamæ.*), *C. fastigiata* (*Temp.*), *Bicellularia plumosa* (*De B.*), *Crisularia plumosa* (*Gray*), *Cellularia fastigiata* (*Flem.*, *Blumenbach*).

Hab.: Salcombe, Fleetwood (*T. H.*), Firth of Forth (*D. L.*, *jun.*), Northumberland (*Ald.*), Menai Straits (*A. S. P.*).

This is the "Soft Feathered Coralline" of Ellis (*Coral.*, 33). It is a very graceful species, of a buff colour, and grows in tufts to a height of 2 inches or more. The cells are biserial and alternate, and each cell possesses a single spine at the top outer angle, and a small avicularium.

6. *B. PURFUROTINGA*, *Norman*.

*Cellularia fastigiata* (*Dal.*), *Cellularia plumosa* (*G. J.*, *Sars*), *Bugula fastigiata* (*Ald.*, *Sars*).

Hab.: Loch Ryan (*D. L.*), St. Andrews (*McI.*), Shetland (*A. M. N.*), Filey (*T. H.*), Wick (*Peach*), Menai Straits (*A. S. P.*).

This species has been confounded with *B. plumosa*, but it is not so graceful. It appears to take its place as a northern form.

It derives its specific name from the fact that when dried it becomes purple in colour.

Each cell is surmounted by a single blunt-jointed spine. The avicularia are larger than in *B. plumosa*.

7. *B. MURRAYANA*, Johnston.

*Flustra Murrayana* (G. J., D. L.), *Flabellaria spiralis* (Gray), *Avicella multispina* (Van Ben.), *Menipea fruticosa* (Packard).

Hab.: Scarborough (*Bean*), Northumberland (*Miss Dale*), Yorkshire and Orkney (*Lieut. Thomas, R.N.*), Stonehaven (*Lady Keith Murray*), Peterhead (*C. W. P.*), Leith, Newhaven (*D. L., jun.*), Lamlash (*T. H.*).

This species very much resembles in mode of growth some kinds of *Flustra*. It grows to about 1 inch in height, and is light coloured. The zoecia are arranged in strap-shaped branches, and 4—12 in breadth. Each cell is armed with a number of marginal spines on each side, and one blunt short spine at each of the upper angles. The oecia are marked with radiating lines.

There is a variety of this species (*fruticosa*) which is more slender in habit, and has narrower branches.

### GENUS III. BEANIA, Johnston.

*Zoarium* subcorneous or calcareous, erect or decumbent. *Zoecia* sessile, erect, scattered, united one to the other by a slender tube, originating from the dorsal surface or from the side near the base. *Aperture* occupying the entire front, the margin furnished with hollow spinous processes arching over the opening;

mouth terminal. *Oœcia* and *Avicularia* wanting.—T. H.

B. MIRABILIS, *Johnston*. Plate XVIII. fig. 5.

Hab.: Scarborough (*Bean*), Salcombe, Torbay, Lam-lash, Isle of Man, Channel Islands (*T. H.*), Hastings (*Miss Jelly*), Peterhead (*C. W. P.*), Ilfracombe (*P. H. G.*).

*Zoœcia* "boat-shaped," 7—10 spines on each side of the aperture, cells connected by a slender tube.

This is a small and beautiful species. The origin of its generic name is as follows. Dr. Johnston says: "This remarkable genus was discovered by Mr. William Bean, of Scarborough. I felt much gratified in associating it with his name. He is well known to naturalists generally by his multitudinous discoveries in British zoology, recent and fossil."

Dr. Landsborough, quoting from Mrs. Gatty, describes the cells as resembling beetles that have lost their heads. The polypide has 20 tentacles.

#### FAMILY V. NOTAMIDÆ.

*Zoœcia* in pairs, each pair arising by tubular prolongations from the pair next but one below it; at each bifurcation a new series of cells intercalated into the branches.—T. H.

#### GENUS I. NOTAMIA, *Fleming*.

*Zoarium* consisting of a creeping tubular stem and erect shoots. *Zoœcia* united laterally in pairs; above each pair two stemmed *avicularia*, originating, one on each side, from the inferior tubular prolongation of one of the cells immediately above. *Oœcia* none.—T. H.

N. BURSARIA, *Linn.* Plate XIX. fig. 1.

*Sertularia bursaria* (*Linn.*, *Berk.*, *Stew.*), *S. bursa* (*Turt.*), *Cellularia bursaria* (*Pall.*, *Ellis*), *Cellaria bursaria* (*E. and S.*, *Lamk.*), *Dynamena bursaria* (*Lamx.*, *De B.*), *Gemicellaria bursaria* (*De Bl.*, *D. L.*), *Epistomia bursaria* (*Gray*).

Hab.: Isle of Wight (*Busk*), Swanage (*Hincks*), Hastings (*Kingsley*).

This species derives its specific name from the resemblance of its cells to the pods of the "Shepherd's Purse," from which Ellis ("Corallines," 41) called it the "Shepherd's Purse Coralline." His description, which is as follows, is accurate and interesting: "This most beautiful pearl-coloured Coralline adheres by small tubes to fuci, from whence it changes into flat cells; each single cell, like the bracket of a shelf, broad at top and narrow at bottom. These are placed back to back in pairs one above another on an extremely slender tube, which seems to run through the middle of the branches of the whole coralline. The cells are open at the top. Some of them have black spots in them, and from the top of many of them a figure seems to issue out like a short tobacco-pipe, the small end of which seems to be inserted in the tube that passes through the middle of the whole. The cells in pairs are thought by some to have the appearance of the small pods of the Shepherd's Purse; by others, the shape of the seed vessels of *Veronica* or speedwell."

This tobacco-pipe appendage alluded to is, of course, the avicularium.

FAMILY VI. CELLARIDÆ. (*Cella*, a cell.)

*Zoæcia* usually rhomboidal or hexangular, disposed in series round an imaginary axis, so as to form cylindrical shoots. *Zoarium* erect, calcareous, dichotomously branched.—T. H.

## GENUS I. CELLARIA, Lamouroux (in part).

*Cella*, a cell.

*Zoarium* jointed at intervals, the internodes connected by flexible horny tubes. *Zoæcia* depressed in front, and surrounded by a raised border, disposed in quincunx. *Avicularia* immersed, irregularly distributed, situated above a cell, or occupying the place of one. *Oæcia* immersed.—T. H.

## 1. C. FISTULOSA, Linn. Plate XVIII. fig. 6.

*Cellaria salicornia* (Lamæ., Lamk., Stark, Bosc, De B., D'Orb.), *C. farciminoïdes* (E. and S.), *Eschara fistulosa* (Linn.), *Cellularia salicornia* (Pall.), *Tubularia fistulosa* (Linn., Berk., Turt., Stew.), *Flustra fistulosa* (Linn.), *Salicornaria salicornia* (Cuvier), *Farcimia fistulosa* (Flem., G. J.), *Salicornaria fistulosa* (Templeton), *S. dichotoma* (Schweigger), *Farcimia salicornia* (G. J., R. Q. C.), *Salicornaria farciminoïdes* (Busk, Reuss, G. J., McA., D. L.).

Hab.: South Cornwall (R. Q. C.), South Devon (T. H.), Northumberland (Ald.), Weymouth (A. S. P.), St. Andrew's (McI.), Shetland (Norman).

The popular name of this zoophyte is the "Bugle Coralline," which was given to it by Ellis (Corall., 46), who says: "This beautiful stony coralline proceeds from membranaceous tubes, which enter into and form cylindrical joints composed of stony lozenge-shaped

cells, with a proper entrance to each. These surround the whole surface of the coralline."

The zoophyte grows to the height of 3 inches, and is white in colour. It is very easily distinguishable by reason of its jointed character and the regular lozenge-shaped cells all over its surface.

2. *C. SINUOSA*, *Hassall*.

*Farcimia sinuosa* (*Hassall*), *F. spathulosa* (*Hassall*), *Salicornaria sinuosa* (*G. J.*, *Busk*, *Ald.*, *D. L.*, *McA.*), *F. salicornia* (*R. Q. C.* in part), *S. farciminoidea* (*Busk*, var.).

Hab.: Belfast and Dublin Bay (*Thompson*), South Devon, Cornwall, Brixham (*T. H.*), Northumberland (*Ald.*), Shetland (*Norman*).

This species grows to a height of 3 or 4 inches. It very much resembles the preceding in appearance, but is distinguished by its stouter growth and larger size.

3. *C. JOHNSONI*, *Busk*.

*Nellia johnsoni* (*Busk*), *Salicornaria johnsoni* (*Busk*, *McA.*).

Hab.: Shetland (*Norman*).

White. Growing to 1½ in. Resembles *C. fistulosa*, but is more slender, and has the avicularia occupying the place of cells.

## FAMILY VII. FLUSTRIDÆ.

*Zoarium corneous and flexible, expanded, foliaceous, erect. Zoecia contiguous, multiserial. Avicularia usually of a very simple type.*—*T. H.*

GENUS FLUSTRA, *Linn.* (*A.-S. Flustrian*, to weave.)

*Zoarium erect, frondose. Zoecia disposed in a single*



layer, or in two layers united by the dorsal surfaces, more or less quadrangular or linguiform, with a raised margin, the *aperture* occupying the whole or a considerable portion of the front of the cell, and closed in by a membranous covering. *Oœcia* immersed.—T. H

*Zoœcia in two layers.*

1. F. FOLIACEA, *Linn.* Plate XIX. fig. 2.

*Porus cervinus* (*Jussieu*), *Eschara foliacea* (*Linn.*, *Pall.*, *Moll.*).

Hab.: Common.

This common zoophyte is popularly called the "Broad-leaved Hornwrack." It grows in fronds somewhat resembling the fronds of algæ, to a height of 4 or 5 inches. The colour is brown, and it possesses a peculiar odour, which has been variously described. Ellis considers it fishy. Grant, Couch, and Hincks liken it to that of the violet; Dr. Landsborough to that of *Verbena*; and Pallas to that of orange. Hooker says, "For curiosity and beauty I have not, among all the plants or vegetables I have yet observed, seen any one comparable to this seaweed" (!).

The zoarium consists of a number of zoœcia, placed side by side, extending along both sides of the fronds, which spread out in a palmate form, and are deeply divided into narrow and broad segments, which are often again subdivided towards the extremities. The segments are narrowed at the base, and are generally rounded at the top. Each cell has *two spines* at each side of the semicircular top. The avicularia are irregularly distributed between the cells.

2. F. PAPYRACEA, *Ellis and Solander.* Plate XIX. fig. 3.

*Flustra chartacea* (Turt., Stew., Bosc, Lamx., R. Q. C., G. J., D. L.), *Chartella papyracea* (Gray).

Hab.: Coast of Sussex (Ellis), Brighton (Lister), Plymouth, Ilfracombe (T. H.).

This species is described by Ellis and Solander (N. H. Z., 13), under the name of the "Paper Sea Mat," as like paper with cells on both sides, having the tops of its branches formed like the edge of an axe. This sea mat is of a slender and delicate texture, like thin semi-transparent paper of a very light straw colour." *F. papyracea* is much smaller and more delicate than the preceding species, growing to the height of about  $1\frac{1}{2}$  inches. The cells have *one spine* at each corner of the upper end.

### 3. *F. SECURIFRONS*, Pallas.

*Eschara foliacea*  $\beta$  (Linn.), *E. securifrons* (Pall.), *Flustra truncata* (Linn., Lamk., Müll., E. and S., Lamx., Flem., G. J., Grant, Hogg, R. Q. C., D. L., McA.), *F. papyracea* (Dal.), *Chartella securifrons* (Gray), *F. tronquée* (De B.).

Hab.: Common on the shores of Scotland and northern shores of England.

This species grows to a height of 4 or 5 inches, and is as much as 3 inches in breadth. It is divided into a large number of narrow segments, from the edges of which "leaflets" often spring. The cells are *oblong*, and have *no spines*. Ellis gave it the name of the "Narrow-leaved Hornwrack," to distinguish it from *F. foliacea*.

### 4. *F. BARLEEI*, Busk.

Hab.: Shetland (Norman).

"This species has large rectangular cells, with no spines. When dry it has a varnished appearance."



*Zoëcia on one side only.*

5. F. CARBASEA, *E. and S.* Plate XIX. fig. 4.

*Carbasea papyracea* (Gray), *C. papyrea* (Busk, Ald., McA.), *F. voile* (De B.), *F. papyrea* (Smitt), *Semiflustra carbacea* (D'Orb.).

Hab.: Aberdeen (*Skene*), Durham coast (*Hogg*), Berwick coast (*G. J.*), Stonehaven (*Lady Keith Murray*), Newhaven (*D. L., jun.*), Filey (*T. H.*).

This species, first described by Ellis and Solander (N. H. Z., 14) under the name of the "Lawn Sea Mat," is easily distinguished from the other *Flustræ* by having cells on one side only, which cells are larger than in any of the other species, and are *egg-shaped at the top, and without spines*. It grows to a height of 2 or 3 inches, and is broad, and of a yellowish-brown colour.

Dr. Grant has calculated that "a common specimen of this zoophyte contains more than 18,000 cells."

## FAMILY VIII. MEMBRANIPORIDÆ.

*Zoarium calcareous or membrano-calcareous, incrusting (so far as British species are concerned). Zoëcia forming an irregular continuous expansion, or in linear series, with raised margins, and more or less membranaceous in front.*—T. H.

GENUS I. MEMBRANIPORA, *De Blainville*.

*Zoarium* incrusting. *Zoëcia* quincuncial, or irregularly disposed, occasionally in linear series; margins raised; front depressed, wholly or in part membranaceous.—T. H.

*With a membranous front wall.*

1. M. LACROIXII, *Audouin*.

*Flustra Lacroixii* (*Savigny*), *F. distans* (*Hassall*), *F. Peachii* (*R. Q. C.*), *Membranipora reticulum* (*Reuss*), *Biflustra Lacroixii* (*Smitt*), *Conopeum reticulum* (*Gray*).

Hab.: Cornwall, South Devon, Ramsay (*T. H.*), Hastings (*Miss Jelly*), Tynemouth (*Ald.*).

This species spreads in colonies over shells and stones. The cells are oval in shape, with thick margins, placed in somewhat irregular rows, and usually having two triangular openings in the crust of the zoarium between each cell and the one below it. The cells are generally armed with spines, which sometimes number two or three stout ones, and at other times are as many as ten or a dozen, in which case they are shorter and more slender.

2. *M. MONOSTACHYS*, *Busk*.

*F. distans* (*D. L.*).

Hab.: Suffolk coast (*Busk*), Ilfracombe (*T. H.*), Yarmouth (*Wigham*), Hastings (*Miss Jelly*).

This species assumes different appearances according to the age of the colony, at first branching in single series, and ultimately increasing in number of rows so as to have the regular colonial appearance. The zoecia are ovate, and have a single erect spine at the bottom of each cell, and also one on each side near the top; sometimes there is a large and varying number (up to 18) of spines distributed round the margin.

3. *M. CATENULARIA*, *Jameson*.

*Tubipora catenularia* (*Jameson*), *T. catenulata* (*Stew.*), *Hippothoa catenularia* (*Flem.*, *Busk*, *G. J.*, *R. Q. C.*, *D. L.*, *McA.*), *H. Elliotæ* (*Gray*), *Pyrifora ramosa* (*D'Orb.*).

Hab.: Generally distributed (in deep water).

This species has been called the "Beaded Coralline,"

and resembles the preceding in mode of growth—usually extending in single linear series. “The zoecia are connected like a string of bugles; the cells are oval, but widest and roundest at the top.”—*Johnston*. Dr. Landsborough, in describing a specimen obtained by him, says that it covered about three inches of a shell in length, and about an inch and a half in breadth. The cells are sometimes marked with parallel lines.

4. *M. PILOSA*, *Linn.* Plate XIX. fig. 6.

*Flustra pilosa* (*Linn.*, *E. and S.*, *Lamk.*, *Lamx.*, *Grant*, *Lister*, *Müll.*, *Bosc*, *Flem.*, *G. J.*, *De B.*), *Eschara pilosa* (*Pall.*, *Moll.*), *Flustra dentata* (*E. and S.*, *Müll.*, *Lamk.*, *Lamx.*, *Bosc*, *De B.*), *F. lineata* (*Esper*), *Membranipora stellata* (*Thompson*), *Annulipora pilosa* (*Gray*), *A. dentata* (*Gray*), *Reptelectrina pilosa* (*D'Orb.*), *R. dentata* (*D'Orb.*).

Hab.: Very common.

This very common but very beautiful zoophyte is the “Irregular Spongy Foliateous Coralline” of Ellis (*Cor.*, 73), who refers to it as “this common sea insect’s cell.” In appearance it often seems to cover the fronds of algae with a silver incrustation, and under the lens the individual cells are seen to be most curiously wrought. The cells are placed either side by side or alternately, and are long and dotted all over with oval discs. A long spine usually proceeds from just below the orifice of each cell, which is also guarded by from 4—12 marginal spines sometimes bending over the cell.

The zooids of this species possess a curious intertentacular organ, which is oblong, and placed between the base of two of the tentacles, and attached to the tentacular ring. It is lined and surmounted with cilia.

Mr. Hincks has studied the purpose of this organ, and, in his opinion, considers that "at certain seasons it is the channel through which *cercariæ* are ejected from the perigastric cavity. The connection proved to exist between this organ and the *cercariæ*—which must be regarded as spermatozoic bodies—may be accepted as conclusive evidence that it is subservient in some way to the function of generation."

5. M. MEMBRANACEA, *Linn.* Plate XIX. fig. 5.

Flustra membranacea (*Linn.*, *Müll.*, *E. and S.*, *Flem.*, *Lamx.*, *R. Q. C.*, *D. L.*, *G. J.*), F. telacea (*Lamk.*), Reptoflustra telacea (*D'Orb.*).

Hab.: Common.

This zoophyte is commonly found spreading in gauze-like areas over the fronds of *fuci*. It spreads to a remarkable extent. Dr. Landsborough and Dr. Johnston have both seen specimens as much as 5 feet in length, with a breadth of 8 inches; and the former observer calculated that "this web of silvery lace had been the work and the habitation of above two millions of industrious and, we doubt not, happy inmates." The cells are quadrangular and oblong, with a blunt spine at each upper angle.

On some of the cells of this species occasionally occur long tower-like transparent processes or cells, which have been considered by some as ovicells, and by others as abnormal growths.

This is the "Chagrin (Shagreen) Sea Mat" of Ellis (*Ellis and Solander*, N. H. Z., 18).

6. M. HEXAGONA, *Busk.*

Flustra coriacea (*G. J.*, *D. L.*).

Hab.: Isle of Man (*Forbes*), Peterhead (*Peach*), Coast of Devon (*Miss Cutler*). Rare.

"The cells are broadly elliptical or hexagonal, with generally two hollow tubercles on the posterior angle of the aperture," *Landsborough*.

7. *M. LINEATA*, *Linn.* Plate XX. fig. 2.

*Flustra lineata* (*Linn.*, *Fabr.*, *Müll.*, *Lamæ.*, *Jameson*, *De B.*, *G. J.*, *D. L.*), *Callopora lineata* (*Gray*), *Reptellectrina lineata* (*D'Orb.*).

Hab.: Common on rocks, shells, and seaweed.

This species spreads in irregularly circular patches. The cells are oval, protected by 6—12 spines, most of which bend across the cell so as almost to meet. The ovicels are large and pearly, and generally accompanied by an avicularium.

8. *M. CRATICULA*, *Alder*.

*Flustra lineata* (*R. Q. C.*).

Hab.: Rare. Northumberland (*Ald.*), Isle of Man, Oban (*T. H.*), Wick, Cornwall (*C. W. P.*).

The cells are oval and regularly arranged. Each cell is protected by about 13 closely-set, glistening spines, the two upper ones being of great length.

9. *M. SPINIFERA*, *Johnston*.

*Flustra spinifera* (*G. J.*).

Hab.: Northumberland and Durham (*Ald.*), Isle of Man, Devon (*T. H.*), St. Andrews (*McI.*).

This species is distinguished from *M. lineata* by its numerous long stout spines (14—18), and its stalked avicularium.

10. *M. FLUSTROIDES*, *Hincks*.

Hab.: Guernsey, Cornwall, South Devon (*T. H.*), Birterbay Bay (*Norman*).

Described by Mr. Hincks in the *Annals of N. H.*, ser. 4, xx. 213.

Mr. Hincks considers this species as transitional

between the *Flustra* and the regular species of *Membranipora*. The cells are large, closely packed and oval, armed with about a dozen large spines incurved. Oval avicularia are scattered amongst the cells as in *Flustra*.

11. *M. DISCRETA*, *Hincks*.

Hab.: South Devon, Guernsey (*Hincks*).

This species was described by Mr. Hincks in the *Annals of N. H.*, ser. 3, ix. 200.

From the description and figure of this species ("British Marine Polyzoa," plate xix. figs. 8, 9), the cells, which are small, appear to be very curious and beautiful; "the margin being cut into about 20 lobes, supporting as many delicate sharply pointed spines, which bend slightly inwards."

12. *M. CURVIROSTRIS*, *Hincks*.

Hab.: In deep waters off Polperro.

Described by Mr. Hincks in the same publication as the last species.

It possesses "large avicularia, with curved and pointed mandibles directed upwards."

13. *M. UNICORNIS*, *Fleming*.

*Flustra unicornis* (*Flem.*, *De B.*), *Membranipora membranacea*, in part (*G. J.*, *D. L.*).

Hab.: Common. Northumberland and Durham (*Ald.*), St. Andrews (*McI.*), Ayrshire coast (*D. L.*), Dogger Bank (*T. H.*).

This species forms extensive coarse gauze-like crusts of a whitish colour. The cells are large and oval, with two spines, one towards the upper part of each side. There is a large avicularium borne at the summit of each ovicel.

14. *M. DUMERILII*, *Audouin*.



*Flustra Dumerilii* (*Audouin*), *M. Flemingii* (*Busk*),  
*M. Pouilletii* (*Ald.*, *Busk*, *McA.*).

Hab.: As last species. Also Isle of Man, Ilfracombe,  
Cornwall (*Hincks*).

This species is allied to the preceding, but is more delicate in texture, and has a small avicularium and strongly granulated ovicels. The zoecia bear 4—6 spines.

15. *M. SOLIDULA*, *Alder and Hincks*.

Hab.: Guernsey (*T. H.*); Hastings (*Miss Jelly*).

This species has small oval cells, with beaded margins and small globular prominences between the cells, each of which has four spines on its upper margin.

Described in the Proceedings of the Dublin Univ. Zool. and Botan. Association, ii., part i. 75.

16. *M. AURITA*, *Hincks*.

Hab.: Cornwall and Devon (*T. H.*), Northumberland (*Ald.*).

Described by Mr. Hincks in the Annals of Nat. Hist., ser. 4, xx. 213.

This species is distinguished by the regular quin-cuncial arrangement of the zoecia, which are ovate, with plain margins. It greatly resembles *M. Flemingii*. The adult cells are armed with one long spine at the side, and two raised avicularia.

17. *M. IMBELLIS*, *Hincks*.

Hab.: Scotland, West Coast, Brixham (*T. H.*).

This species has large "pyriform" cells without spines or avicularia, and is considered by Mr. Busk as "an unarmed variety of *M. Flemingii*;" but Mr. Hincks considers it a separate species. The margins of the zoecia are incurved and granulated. It is found at a depth of 40—60 fathoms.

*With a calcareous lamina.*18. *M. FLEMINGII*, Busk. Plate XX. fig. 1.

*Flustra membranacea* (Müll., Fabr.), *F. tuberculata* (G. J., R. Q. C.), *Amphiblestrum membranaceum* (Gray).

Hab.: Common.

In this species the zoecia are ovate, deep, and extended beneath the apparent surface. The aperture is trifoliate, and each cell has 6—8 spines, one of which in the centre of the margin is jointed to a tubular base, and is long, and “bears no small resemblance to the blade of a scimitar.” The appearance of the zoophyte, with its array of sword-like spines guarding each cell, is very curious. In exposed situations these long spines are either not produced or are very soon rubbed off.

19. *M. CORNIGERA*, Busk.

Hab.: Shetland (A. M. N.).

This is a rare species from deep water. The zoecia are lozenge-shaped, with 6 spines, the lowest pair of which are forked. Large oblong avicularia are distributed amongst the cells.

20. *M. ROSSELLII*, Audouin.

*Flustra Rossellii* (Aud., Savigny).

Hab.: Shetland (A. M. N.), Isle of Man, Torbay (T. H.), Peterhead (C. W. P.).

This species forms brown crusts on shells and stones. There are no avicularia, and the zoecia are oval, pointed below with raised and finely beaded margins.

21. *M. TRIFOLIUM*, S. Wood.

*Flustra trifolium* (S. Wood), *Membranipora solida* (Packard), *M. sacculata* (A. M. N.).

Hab.: Shetland (A. M. N.), Wick (C. W. P.).

This species much resembles the preceding. The



colonies are of a pale olive-green or reddish-brown colour. It is found at a depth of 40—170 fathoms.

22. *M. MINAX*, *Busk*.

Hab.: Shetland (*A. M. N.*).

Described by Mr. Busk in the Q. J. M. S., viii. (1860), 125.

The cell is pyriform, with two long spines on each side near the top, and a large pointed avicularium on the margin at the bottom of the cell.

23. *M. NODULOSA*, *Hincks*.

Hab.: South Devon, Brixham (*Hincks*).

This species is found on shells at a depth of 30 fathoms and over. The cells are oval, without spines or any ornamentation. Below each is a prominent boss or projection.

GENUS II. *MEGAPORA*, *Hincks*. (*μέγας*, large, and *πόρος*, an opening.)

*Zoarium* incrusting. *Zoæcia* with a depressed area in front, surrounded by a raised margin, and partially closed in by a calcareous lamina. *Aperture* trifoliate, the lower portion filled in by a horny plate, on which the opercular valve works.—T. H.

1. *M. RINGENS*, *Busk*.

*Lepralia ringens* (*Busk, A. M. N.*).

Hab.: Shetland. 80—170 fathoms (*A. M. N.*).

This species grows in small patches. The cells are large and ovate, with "an inclosed area occupying the upper portion of the front surface." There are about 6 spines on the upper margin, and there is a tall spine on the side of the cell.

It was described by Mr. Busk in the Q. J. M. S., iv. (1856), 308.

## FAMILY IX. MICROPORIDÆ.

*Zoæcia with the front wall whole, calcareous ; margins elevated.*—T. H.

GENUS I. MICROPORA, *Gray.* (μικρὸς, small.)

*Zoarium* incrusting. *Zoæcia* with prominent raised margins; front depressed, wholly calcareous; orifice semicircular or suborbicular, enclosed by a calcareous border.—T. H.

1. *M. CORIACEA*, *Esper.* Plate XX. fig. 3.

*Flustra coriacea* (*Esp.*, *D. L.*), *Discopora coriacea* (*Lamk.*), *Membranipora coriacea* (*Busk, McA.*).

*Hab.*: Shetland (*A. M. N.*), Cornwall, Guernsey (*T. H.*), Hastings (*Miss Jelly*), Aberdeenshire (*C. W. P.*), Isle of Man (*Forbes*).

The cells in this species are broad with thickened margins, those at the sides terminating in a distinct knob at the top. The orifice is small and semicircular, with a straight lower margin. The whole of the cell is dotted with small punctures. The appearance of each cell is very suggestive of a mummy.

2. *M. COMPLANATA*, *Norman.*

*Lepralia complanata* (*A. M. N.*), *Membranipora Smittii* (*Manzoni*).

Described by Mr. Norman in the *Annals of Nat. Hist.*, January, 1864, page 84, from specimens without label in Mr. Barlee's collection.

GENUS II. STEGANOPORELLA, *Smitt.* (στεγανὸς, covered, porella, a little opening.)

*Zoarium* incrusting or (occasionally) rising into foliaceous expansions. *Zoæcia* with the external characters

of *Micropora*, but having an inner chamber occupying the whole of the cavity below, and above narrowed into a tubular passage which either communicates directly with the orifice or opens into a second chamber immediately beneath it.—T. H.

S. SMITH.

*Membranipora andigavensis* (Busk).

This species was discovered by Mr. Peach on the tube of a *Serpula* off the Cornish coast.

The zoecia resemble those of *Micropora*, but have an inner chamber occupying most of the cavity, and communicating with the orifice by a tubular passage.

The avicularia are nearly as large in area as the zoecia, and have a prominent dark horn-coloured mandible.

GENUS III. SETOSELLA, Hincks. (*Setosa*, bristly.)

*Zoarium* incrusting. *Zoecia* with raised margins; front depressed and wholly calcareous. *Aperture* semi-circular. *Vibracular cells* alternating with the zoecia throughout the colony. *Vibraculum* slender and setiform.—T. H.

S. VULNERATA, Busk.

*Membranipora vulnerata* (Busk).

Hab.: Shetland, on the very smallest stones at a depth of 80—110 fathoms (*A. M. N.*).

The cells are oval, with a raised smooth margin. A little above each cell is a long bristle or *vibraculum*, whence the generic name is derived.

Described by Mr. Busk in the Q. J. M. S., viii. 124, and by Mr. Hincks in the Ann. and Mag. N. H., Dec., 1877, and July, 1880.

## FAMILY X. CRIBRILINIDÆ.

*Zoarium* adnate, forming an indefinite crust, or erect. *Zoecia* having the front wall—more or less—fissured, or traversed by radiating furrows.—T. H.

GENUS I. CRIBRILINA, Gray. (*Ocribrum*, a sieve.)

*Zoarium* incrusting. *Zoecia* contiguous, having the front more or less occupied by transverse or radiating punctured furrows; orifice semicircular or suborbicular.—T. H.

## 1. C. RADIATA, Moll.

*Eschara radiata* (Moll.), *Lepralia innominata* (R. Q. C., D. L., G. J., Busk, T. H., Manzoni), *L. scripta*, *L. pretiosa*, *L. calomorpha* (Reuss), *Reptescharella pygmæa* (D'Orb.), *C. innominata* (Smitt), *L. annulata* (Heller, Manzoni).

Hab.: Common on South and South-West Coasts, and to the West Coast of Scotland.

"The cells are white, ovate, and sometimes almost orbicular, and when the ribs diverge from a central umbo, each cell is like a *pecten* in miniature."—*Landsborough*. Some varieties have five or six spines.

The cell, like that of many other Polyzoa, is richly sculptured, a large number of ribs or ridges branching towards the margin from a central line, point, or projection, the interspaces being often decorated by punctures and dots. The appearance of the colonies is subject to considerable variation, being sometimes delicate and gauze-like, at others coarse and dull in colour.

## 2. C. PUNCTATA, Hassall. Plate XX. fig. 4.

*Lepralia punctata* (Hassall, Busk, G. J., D. L.), *Escharipora punctata* (Smitt).

Hab.: Widely distributed on rocks and algæ between tide marks.

The young cells are whitish, becoming grey and coarse when old. The cells vary considerably in appearance, being sometimes elongated and decorated with marginal tubercles and cross ribs, at other times without ribs or tubercles; sometimes with a number of ridges proceeding from a central raised area, at other times almost plain; sometimes with prominent spines, at others with inconspicuous ones. The cells are always more or less dotted with perforations, and there is usually an avicularium on each side of the orifice.

3. *C. ANNULATA*, *Fabricius*.

*Cellepora annulata* (*Fabr.*), *Lepralia annulata* (*Busk*, *G. J.*, *D. L.*), *Escharipora annulata* (*Smitt*).

Hab.: Shetland (*A. M. N.*), Cumbræ (*D. L.*), Oban (*T. H.*), St. Andrews (*McI.*), Cornwall (*T. H.*).

This species is called by its earliest discoverer, "pulcherrima et perfectissima hæc omnium visarum." Dr. Landsborough calls it a very pretty species, and describes each cell as being like a little barrel closely hooped, and having transverse rows of perforations betwixt the hoops. There is often a median line from the top to the bottom of the cell. The colour in general is a pale brownish-red.

There are often three or four spines in the upper margin of the cell.

4. *C. FIGULARIS*, *Johnston*.

*Lepralia figularis* (*G. J.*, *D. L.*, *T. H.*, *Gray*, *Busk*), *Escharipora figularis* (*Smitt*).

Hab.: Cornwall (*C. W. P.*), Guernsey (*T. H.*), Hastings (*Miss Jelly*).

The zoecia in this species somewhat resemble those of the preceding, but they have a row of small tubercles just inside the margin, a tubercle terminating each of the cross ribs. The cells are barrel-shaped.

5. *C. GATTYÆ*, *Busk*. Plate XX. fig. 5.

*Lepralia Gattyæ* (*Busk, D. L.*), *Lepralia Steindachneri* (*Heller*).

Hab.: Sidmouth (*Mrs. Gatty*), Guernsey (*T. H.*), Hastings (*Miss Jelly*).

In Dr. Landsborough's "Popular History of British Zoophytes" is the following description by its discoverer, Mrs. Gatty:—"The centre of each cell is ornamented with a rich pattern, and this is a very characteristic feature. At the foot of each of the five spines that surround the mouth or aperture is a black ring, and below the mouth there is on each side a single fine spine, which may be compared, perhaps, to a cat's whisker (a vibraculum). In the middle of all there is a knob or projection (more or less obvious in different individuals), and round this "umbo-like" projection there is a circle of small dots or punctures. From this circle emanate rays or raised lines, between each of which there is to be found a dot or puncture, larger in size than those of the other circle. These rays and stars are alternate, and so form a circle outside the circle that surrounds the umbo."

## GENUS II. MEMBRANIPORELLA, *Smitt*.

*Zoarium* incrusting, or rising into free, foliaceous expansions, with a single layer of cells. *Zoecia* closed in front by a number of flattened calcareous ribs more or less consolidated.—*T. H.*

1. *M. NITIDA*, *Johnston*. Plate XX. fig. 6.



*Cellepora nitida* (Lamk., Fabr.), *Escharoides nitida* (M. Edw.), *Berenicea nitida* (Flem.), *Lepralia nitida* (G. J., R. Q. C., D. L., Busk, T. H., Smitt), *Bérénice brillante* (De B.), *Membranipora nitida* (Smitt).

Hab.: Isle of Man (Forbes), Devonshire (T. H.), Cornwall (C. W. P.), Ayrshire, Ross-shire coast (D. L.), Shetland (A. M. N.), Berwick (G. J.).

This is a beautiful little species. "It is like a miniature human thorax; the cross pieces representing the ribs, and the broad band into which these are inserted being analogous to a sternum."—Hassall. "We might suppose it the thorax of a pretty little fairy."—Landsborough.

The colonies have a shining appearance, in fact an almost metallic lustre.

2. *M. MELOLONTHA*, Busk.

*Lepralia melolontha* (Busk, D. L.), *Lepralia nitida* (var. G. J.).

Hab.: Thames Estuary (Lieut. Thomas), East Coast (Mrs. Gatty).

This species was at first thought to be a variety of the preceding, but it has been separated from it. It derives its specific name from the fact, that many of the cells resemble a cockchafer or tailed beetle, in having a strong spine turning up almost at right angles from the bottom. This species grows in a branched manner, and not in alternate rows, as in *M. nitida*.

Dr. Johnston describes it as "branched in a fine dendritic manner, like *Stomatopora dilatans*."

#### FAMILY XI. MICROPORELLIDÆ.

*Zoecia* adnate and incrusting, or forming erect and foliated or dendroid zoaria; orifice more or less semi-

*circular, with the lower margin entire; a semilunate or circular pore on the front wall.*—T. H.

GENUS I. MICROPORELLA, *Hincks*. (μικρὸς, small, and πορὸς.)

*Zoarium* incrusting. *Zoæcia* with a semicircular aperture, the lower margin entire, and a semilunate or circular pore below it.—T. H.

1. M. CILIATA, *Pallas*. Plate XX. fig. 7.

*Eschara ciliata* β (*Pall.*), *Cellepora ciliata* (*Linn.*, *Fabr.*, *Bosc*, *Lamæ.*), *Eschara vulgaris* β (*Moll.*), *Leporalia ciliata* (*G. J.*, *D. L.*, *R. Q. C.*, *Busk*), *L. insignis* (*Hassall*), *L. personata* (*Busk*), *L. lunata* (*Macgillivray*), *L. utriculus* (*Manzoni*), *Flustra Genisii* (*Aud.*, *Savigny*), *Escharina vulgaris* (part) (*M. Edw.*), *Reptoporellina subvulgaris* (*D'Orb.*), *Cellepora crenilabris* (*Reuss*), *C. pleuropora* (*Reuss*), *Porina ciliata* (*Smitt*), *Porellina ciliata* (*Smitt*).

Hab.: Generally distributed, on sea weeds, shells, and stones. Mr. Couch calls this the "branched cellepore." It assumes a variety of forms. The cells are ovate, and frosted, the aperture is arched with a straight lower margin and is armed with five to seven spines. This, along with the other species of this genus, is distinguished by what is called a *median pore* or opening in the front wall of each cell probably having respiratory functions. In the present species the median pore is often borne on a *mucro* or knob. The avicularia are large and often curiously modified in structure; four distinct types of avicularia being recognized by Mr. Hincks (*A. M. N. H.*, ix. 25).

2. M. MALUSII, *Audouin*.

*Cellepora Malusii* (*Aud.*, *Savigny*), *Cellepora Macry*



(*W. Thompson*), *Lepralia biforis* (*G. J., D. L.*), *L. Malusii* (*Busk, Heller, Manzoni*), *L. thyreophora* (*Busk*), *Herentia biforis* (*Gray*), *Escharina cornuta* (*D'Orb.*), *Reptoporina Malusii* and *R. hexagona* (*D'Orb.*), *Porina Malusii* (*Smitt*).

Hab.: Strangford Lough (*Thompson*), Larne (*Patterson*), Ayrshire Coast (*D. L.*), Sidmouth (*Mrs. Gatty*), Wick (*C. W. P.*), Guernsey, South Devon, Cornwall, Isle of Man (*T. H.*).

This is a well-marked species. The cells are ovate and glistening, punctured except in the centre. The orifice is armed with three or four spines. The median pore is half-moon shaped, very large, and "guarded with delicate teeth so as to act as a sieve or strainer."

3. *M. IMPRESSA*, *Audouin*. Plate XX. fig. 8.

*Flustra impressa* (*Aud., Savigny*), *Lepralia granifera* (*G. J., Busk, D. L., Ald.*), *L. pyriformis* (*Busk*).

Hab.: Holy Island, Berwick Bay (*G. J.*), Cornwall (*C. W. P.*), Saltcoats (*D. L.*), Shetland (*A. M. N.*), Ilfracombe, South Devon, Isle of Man (*T. H.*).

The following notes by *Mrs. Gatty* describe this species:—"The typical forms of *M. impressa* (*L. granifera*, *Johnston*) may be considered to lie between two extremes. One extreme variety lies flat to the seaweed, and is cut into a finely-marked diamond pattern, round the four sides of which are a row of dots or punctures. There is also an opening below the mouth" (the median pore, which is circular in this species). "The pure transparency of the cell in its young condition—varied by a thicker line which marks out its diamond shape, and in which lie the row of dots—makes it a very pretty object. It is so glassy in texture that the colour of the red *phyllophora* can be

distinguished through the cells. As it advances in age the opening below the mouth looks as if it was on a raised knob, and the flat appearance of the cell is gone. The other extreme form is one in which the side horns and the heavy knob are so prominent as to be the leading features of the species. In modified instances the front protuberance is lower and the horns less distinct."

4. *M. VIOLACEA*, *Johnston*.

*Lepralia violacea* (*G. J.*, *Busk*, *Manzoni*, *D. L.*), *L. plagiopora* (*Busk*), *L. diversipora* (*Reuss*), *Porina violacea* (*Smitt*), *P. plagiopora* (*Smitt*).

Hab.: Isle of Man (*Forbes*), Cornish Coast (*C. W. P.*), Hastings (*Miss Jelly*), Brixham, Torbay, Guernsey (*T. H.*).

This species forms irregular crusts of a violet or cream colour on shells, stones, &c. The cells are ovate, with a rough granular surface, depressed in the middle, where there is a large circular median pore. There is also an avicularium. The old cells lose their beauty and become "almost confluent of a dead whitish colour, flattish and sometimes thickly perforated." In a specimen now before me the perforations are extremely large.

GENUS II. *DIPORULA*, *Hincks*. ( $\delta$ is, double.)

*Zoecia* with the orifice arched and expanded above, contracted below, and slightly constricted by two lateral projections (horseshoe-shaped), lower margin straight; a semilunate pore on the front wall. *Avicularia*.—*T. H.*

1. *D. VERRUCOSA*, *Peach*.

*Eschara verrucosa* (*C. W. P.*), *E. lunaris* (*Waters*).

Hab.: Lautivet Bay, Cornwall (*C. W. P.*).

This rare species is distinguished by its dendroid manner of growth. It is of a light brown colour. The branches are cylindrical; the cells become so incrustated that in the older specimens sometimes only the orifice is visible.

GENUS III. CHORIZOPORA. ( $\chi\omega\rho\iota\zeta\omega$ , to separate.)

*Zoæcia* more or less distant, connected by a tubular network; the orifice semicircular, with the inferior margin entire; the special pore wanting.—T. H.

1. *C. BRONGNIARTII*, *Audouin*. Plate XX. fig. 9.

*Flustra Brongniartii* (*Aud.*, *Savigny*), *Lepralia tenuis* (*Hassall*, *G. J.*, *D. L.*), *L. assimilis* (*G. J.*, *D. L.*), *L. Jacotini* (*Gray*), *L. Brongniartii* (*Busk*, *Ald.*, *Heller*), *Mollia tuberculata* (*D'Orb.*), *M. Brongniartii* (*D'Orb.*), *L. capitata* (*Reuss*).

Hab.: Dublin Bay (*Hassall*), Cornwall (*C. W. P.*), Sidmouth (*Mrs. Gatty*), Lamlash (*D. L.*), Ilfracombe, Isle of Man (*T. H.*), Hastings (*Miss Jelly*), Sana Island (*Hyndman*), Shetland (*A. M. N.*), Filey (*A. S. P.*).

The cells in this species are long in proportion to their breadth. The surface is sometimes smooth and at others furrowed. The cells are often separated by expansions of the crust which are perforated by a series of apertures or spaces covered with tubercles. There is an avicularium at the top of each.

The cells are connected with each other by tubes. In forms where the cells are close together, they appear to be surrounded by a line of punctures or apertures.

FAMILY XII. PORINIDÆ, *D'Orbigny*.

*Zoarium* incrusting, or erect and ramified. *Zoecia* with a raised tubular or subtubular orifice, and frequently a special pore on the front wall.—T. H.

GENUS I. PORINA, *D'Orbigny*.

*Zoecia* tubular or subtubular above, with a terminal circular orifice; a median pore on the front wall. *Zoarium* (in the British species) incrusting, or erect and ramose.—T. H.

(a) *Zoophyte erect, branching.*1. *P. BOREALIS*, *Busk*.

*Pustulipora gracilis* (*Sars*), *Onchopora borealis* (*Busk*, *McA.*), *Quadricellaria gracilis* (*Sars*, *Ald.*), *Anarthropora borealis* (*Smitt*), *Tessaradoma gracile* (*A. M. N.*), *T. boreale* (*Smitt*).

Hab.: Shetland (*A. M. N.*). On stems of *Tubulariæ* and *Sertulariæ*, from deep water.

Height 1—2 in.

This species is white and dichotomously branched. "The cells are ovate, arranged in four longitudinal rows alternating regularly with each other, so that the opposite cells are on the same level." Each cell has a row of pores round its margin, and one or more small circular avicularia.

(b) *Zoophyte incrusting.*2. *P. TUBULOSA*, *Norman*.

*Lepralia tubulosa* (*A. M. N.*, *T. H.*), *Anarthropora monodox formâ minuscula* (*Smitt*), *Cylindroporella tubulosa* (*T. H.*).

Hab.: Shetland (*A. M. N.*), Wick (*C. W. P.*).

The cells are arranged in rows. They are narrow, with a circular orifice terminating a long tubular neck. There is a large tubular pore a little distance below the orifice. The cells are dotted with minute star-shaped pores.

GENUS II. CELLEPORELLA, *Gray*.

*Zoecia* suberect, anterior extremity tubular and free, with a terminal circular orifice. No special pores. *Zoarium* incrusting.—T. H.

1. *C. LEPRALOIDES*, *Norman*.

2. *C. PYGMÆA*, *Norman*.

These species are very minute, and were both found in very deep water at Shetland by the Rev. A. M. Norman, who described the former in the Q. J. M. S. (N.S.), viii., 222, and the latter in the Report of the Brit. Ass., 1868, p. 308.

GENUS III. ANARTHROPORA, *Smitt*. (ἀνάρθρος, unjointed.)

*Zoecia* with the oral extremity slightly produced and free, subtubular; orifice terminal, semicircular; an avicularian pore on the elevated portion of the cell in front, special pore wanting. *Zoarium* (in the British species) adnate.—T. H.

1. *A. MONODOX*, *Busk*.

*Lepralia monodox* (*Busk*).

Hab.: Shetland (*A. M. N.*), from deep water.

In the young state this species is very beautiful, being richly ornamented with stellate pores or openings, which become lost in reticulations in the older cells. The cells are ovate, with a tubular neck. The Zoo-phyte forms branching colonies on stones, &c., at a depth of 80—300 fathoms.



GENUS IV. LAGENIPORA, *Hincks*. (*Lagena*, a flask.)

*Colonies* consisting of a number of cells immersed in a common calcareous crust. *Zoecia* decumbent, contiguous, lageniform; oral extremity free, tubular, with a terminal orbicular orifice.—T. H.

1. *L. SOCIALIS*, *Hincks*.

Hab.: Hastings (*Miss Jelly*).

This zoophyte (described by Mr. Hincks in the *Ann. N. H.*, Sept., 1877, 215) forms small white colonies incrusting the shell of *Pecten maximus*.

The cells are ornamented with granular markings, and are flask-shaped, with long tubular necks.

FAMILY XIII. MYRIOZOIDÆ, *Smitt*.

*Zoarium* incrusting, or rising into foliaceous expansions, or dendroid. *Zoecia* calcareous, destitute of a membranous area and raised margins; orifice with a sinus on the lower lip.—T. H.

GENUS I. SCHIZOPORELLA, *Hincks*. ( $\sigma\chi\iota\zeta\omega$ , I divide.)

*Zoecia* with a semicircular or suborbicular orifice, the inferior margin with a central sinus. *Avicularia* usually lateral, sometimes median, with an acute or rounded or spatulate mandible; occasionally wanting. *Zoarium* (in the British species) incrusting, or (occasionally) forming foliaceous specimens.—T. H.

1. *S. UNICORNIS*, *Johnston*. Plate XXI. fig. 1.

*Berenicea coccinea* (*G. J.*), *Lepralia coccinea* (*G. J.*), *L. unicornis* (*G. J.*, *D. L.*, *Ald.*, *T. H.*, *Busk*, *McA.*), *L. spinifera* (*Busk*, *McA.*, *Heller*, *Manzoni*), *L. ansata* (*G. J.*, *Busk*, *McA.*, *D. L.*, *T. H.*, *Reuss*, *Heller*, *Manzoni*),

*L. tetragona* (*Reuss, Manzoni*), *Reptoporina tetragona* (*D'Orb.*), *Escharina variabilis* (*Leidy*).

Hab.: Ayrshire (*D. L.*), Cornwall (*C. W. P.*), Hastings (*Miss Jelly*), The Minch (*A. M. N.*), Cornwall, Ilfracombe, Filey (*T. H.*).

Two distinct forms of this species are recognized, namely *unicornis* and *ansata*. In the former the cells are very distinct and somewhat rectangular, with a small orifice, below which is a pointed mucro. On one or both sides is an avicularium. The oecia are scallop-shaped, with grooved radiations. In the latter form, which "represents the deep-water condition of the species," the cells are broad and squarish, and the oecia are small and without ornament. Dr. Johnston describes the avicularia as "auricles," and says that "when viewed in front they have a miniature resemblance to the ears of a fox or a cat."

2. *S. SPINIFERA*, *Johnston*.

*Lepralia ciliata* (*Hassall*), *Mollia vulgaris* formâ *spinifera* (*Smitt*), *Lepralia spinifera* (*G. J., Busk, McA., T. H., Heller*, in part).

Hab.: Shetland (*A. M. N.*), St. Andrews (*McI.*), Wick (*C. W. P.*), Llandudno, Ilfracombe, &c. (*T. H.*), Hastings (*Miss Jelly*).

Resembles *M. ciliata*, but has the orifice more rounded, with a semicircular snip out of the lower margin. The cells are generally smooth or only slightly punctured. There are 4—6 spines upon the upper half of the aperture, and there is a long spine on the cell a little below the aperture, often with an avicularium in a line with it on the front of the cell. This long spine is inserted in a boss or circular tubercle. Sometimes there are two of these long spines, one

below the other. The ovicels are marked with depressed lines extending radially from the margin towards the centre.

3. *S. ALDERI*, *Busk*.

*Alysidota Alderi* (*Busk, A. M. N.*), *Lepralia Barleei* (*Busk, McA.*).

Hab.: Shetland (*A. M. N.*).

This is a deep-water species. The zoecia are oval, with a small aperture, below which is a boss or tubercle. The surface of the cell is dotted, and there is a row of distinct punctures round the margin. The cells are sometimes massed together, at others they extend in a linear series.

4. *S. VULGARIS*, *Moll.*

*Eschara vulgaris* (*Moll.*), *Escharina vulgaris* (*Lamk.*), *Cellepora vulgaris* (*Lamæ.*), *Lepralia vulgaris* (*Busk, T. H.*), *L. alba* (*T. H.*), *Cellepora othopora* (*Reuss*), *L. othopora* and *L. intermedia* (*Reuss*).

Hab.: Hastings (*Miss Jelly*), Birterbuy Bay (*A.M.N.*).

The cells are oval with a semicircular orifice, the lower margin of which is straight, with a notch in the centre. There are 3—4 spines on the upper margin of the orifice, and two long jointed spines on each side of the face of the cell about the centre. There is occasionally an umbo or boss below the orifice.

5. *S. JOHNSTONI*, *Johnston*.

*Lepralia simplex* (*G.J., D.L., T.H., McA., Gray, Busk*), *S. simplex* (*T. H.*).

Hab.: Off Sana Island (*Hyndman*), South Devon (*T. H.*), Hebrides (*A. M. N.*), Hastings (*Miss Jelly*).

The cells are elongately oval, with a collar-like margin round the orifice, below which is an umbo. The ovicels are ornamented with two or three bosses.



6. *S. LINEARIS*, *Hassall*.

*Lepralia linearis* (*Hassall*, *Manzoni*, *Busk*, *McA.*, *G. J.*, *D. L.*, *A. M. N.*), *L. hastata* (*T. H.*), *L. tenella* (*Reuss*), *Escharella linearis* (*Smitt*), *Herentia linearis* (*Gray*).

Hab.: Very generally distributed.

The cells are oblong, with a small orifice surmounted by two or three spines in the centre of the top margin. There is an avicularium on each side of the face of the cell, and between these avicularia is a small umbo. The surface of each cell is punctured, and the margins between the cells are very distinct. The cells are very regularly placed side by side, and the colonies are rose-coloured.

There are several variations in the appearance of this zoophyte, caused mainly by differences in the characters of the avicularia.

7. *S. SANGUINEA*, *Norman*.

*Hemeschara sanguinea* (*A. M. N.*), *Escharella sanguinea* (*Smitt*).

Hab.: Guernsey (*A. M. N.*), Cornwall (*T. H.*). A deep-water species.

This is a very pretty species, the zoecia being arranged in regular rows. They are square with rounded tops and semicircular orifices, the lower margin of each orifice being cut into three notches. The margins are distinct, and each cell is pitted with small depressions arranged in linear rows. Though generally found incrusting stones, &c., it occasionally assumes an erect growth.

8. *S. CRISTATA*, *Hincks*.

Hab.: Hastings (*Miss Jelly*).

This species is described by Mr. Hincks from a single specimen. The cells are rhomboidal. The orifice is surmounted by 5 spines; the lower margin of

the orifice is extended, and bears a large tooth-like projection. The ovicels are mitriform with a beaded margin, and as well as the zoecia, are marked with punctures.

The colony described had a silvery appearance.

9. *S. BIAPERTA*, *Michelin*.

*Eschara biaperta* (*Michelin*), *Lepralia biaperta* (*Busk, Manzoni*), *Reptoporina biaperta* (*D'Orb.*), *Hippothoa biaperta* and *H. divergens* (*Smitt*).

Hab.: Guernsey (*A. M. N.*), Hastings (*Miss Jelly*).

The colonies are white and glossy. The zoecia are irregularly ovate, sometimes almost square. The orifice is pear-shaped, and on one or both sides of the orifice is a rounded raised avicularium. Here and there amongst the zoecia are round large *mamillæ* bearing avicularia with long beaks. The ovicels are ornamented with radiating lines.

10. *S. ARMATA*, *Hincks*.

Hab.: Polperro (*T. H.*).

From the drawing of this given by Mr. Hincks (*B. M. P.*, plate xli., figs. 7, 8) it would appear to be a remarkable and easily recognized species. The cells are large and squarely ovate, granulated, and with a collar-like margin round the orifice, which is circular with a squarish notch at the bottom. On the shoulder of the cell is a prominent avicularium, with occasionally a long duckbill-shaped mandible. Rising from the upper margin of the orifice are four very long spines. The ovicels are globular and slightly wrinkled. The colour of the colonies is grey or brown.

11. *S. AURICULATA*, *Hassall*.

*Lepralia auriculata* (*Hassall, Busk, McA., G. J., D. L.*), *L. ochracea* (*T. H.*), *Escharella auriculata* (*Smitt*).

Hab. : Shetland (*A. M. N.*), Northumberland (*Ald.*), Isle of Wight (*Busk*), Isle of Man, Devon, Cornwall (*T. H.*), Dublin (*Hassall*).

The cells are more or less rhomboidal, and regularly arranged in straight rows. The orifice is circular, with a notch or sinus. Below this is an avicularium of varying shape, often mounted on a mucro or boss. The cells are separated by distinct margins, and are usually much punctured. Above the orifice are 2—4 prominent spines.

The colonies are red in colour, and are found on shells and stones at varying depths.

12. *S. UMBONATA*, *Busk*.

*Lepralia umbonata* (*Busk, McA.*).

Hab. : Shetland (*Barlee*).

Described by Mr. Busk in the *Q. J. M. S.*, viii., 143. It appears to resemble very closely *S. auriculata*.

13. *S. DISCOIDEA*, *Busk*.

*Lepralia discoidea* (*Busk, McA., Hincks*), *Alysidota conferta* (*Busk*).

Hab. : Shetland, Hastings (*Miss Jelly*), Guernsey (*T. H.*).

The cells are squarely ovate, distinctly punctured, having a somewhat triangular orifice with a raised margin. The cells are armed with six or seven spines, and there is one (and sometimes a second) avicularium on the front of the cell a little below the orifice.

The smallest cells are in the centre of the colony. This gives the zoarium a hollowed or depressed appearance, which makes the species readily recognizable.

The oœcia are hooded and punctured like the cells.

14. *S. SINUOSA*, *Busk*.



*Lepralia sinuosa* (*Busk*), *Escharella linearis forma secundaria* (*Smitt*).

Hab.: Shetland (*A. M. N.*), West of Scotland (*T. H.*).

The colonies are red in colour, and are found at varying depths to 150 fathoms.

The zoëcia are irregularly rhomboidal or ovate in shape, marked with punctures, or in some cases with a reticulated pattern. The orifice is placed at the upper margin of the cell, and is circular, with a notch below. The oëcia have a distinct circular perforation in the centre, and are granulated. In this and the succeeding species of this genus the avicularia are usually wanting.

15. *S. CECILII*, *Audouin*.

*Flustra Cecillii* (*Aud.*, *Savigny*), *Lepralia Cecillii* (*Busk*, *McA.*, *T. H.*), Jersey (*Mrs. Buckland*), Guernsey (*T. H.*).

This is a deep-water species, forming "vitreous and glistening colonies when fresh." The cells have large punctures and distinctly semicircular orifices, with a single notch or sinus in the centre of the lower margin of each. The oëcia are large and prominent.

16. *S. CRUENTA*, *Norman*.

*Lepralia violacea* (var. *cruenta*, *Busk*), *L. cruenta* (*A. M. N.*), *Discopora cruenta* (*Smitt*).

Hab.: Shetland (*A. M. N.*), Channel Islands (*Busk*), Peterhead (*C. W. P.*).

This is a rare species from deep water. It forms deep red-coloured colonies, sometimes turning black when dry.

The cells are very irregular in shape, with very large punctures over the front and round the margin of each. There are no spines or avicularia, but the orifice has a broad margin which is a conspicuous feature.

17. *S. HYALINA*, *Linnæus*. Plate XXI. fig. 2.

*Cellepora hyalina* (*Linn.*, *Fabr.*, *Bosc*), *C. nitida* (*Fabr.*), *C. personata* (*D. Chiaje*), *Escharina personata* (*M. Edw.*), *Berenicea hyalina* (*Hassall*, *Flem.*, *De Bl.*, *G. J.*), *Lepralia hyalina* (*W. Thompson*, *G. J.*, *D. L.*, *Busk*, *McA.*), *Celleporella hyalina* (*Gray*), *Mollia hyalina* (*Smitt*).

Hab.: Common.

The colonies formed by this species are of a whitish colour, varying in shade from silvery-white to dull grey. The cells are long and narrow, of an oval shape, with the orifice at the top of each cell. This orifice is rounded, with a sinus in front. The cells are often separated by "punctured spaces." There are several variations in the ornamentation of the zoecia. In some forms there are one or more processes on each side of the mouth. In others there is a prominent boss below the orifice. The cells are often marked with minute granulations and indistinct transverse bars. The oecia are large, globular, with distinct perforations, and are borne on aborted zoecia. There are no spines or avicularia. Though common this is a pretty species, and occurs in roundish patches on algæ, &c.

18. *S. VENUSTA*, *Norman*.

*Lepralia venusta* (*A. M. N.*), *Gemellipora glabra* (*Smitt*).

Hab.: Guernsey (*A. M. N.*).

This species forms pretty colonies when young, but as the zoecia get old they become dull and coarse. The cells are lozenge-shaped, with rounded punctures. The orifices are circular with a sinus in the lower circumference of each, and below each orifice is a more or less elongated umbo or boss. This species is armed

with avicularia which are borne on distinct rectangular interspaces between the cells.

GENUS II. MASTIGOPHORA, *Hincks*. (μάστιξ, a whip, and φέρω, I bear.)

*Zoëcia* with a semicircular orifice, the inferior margin straight, with a central sinus; furnished with lateral vibracula. *Zoarium* (in British species) incrusting.—T. H.

This genus differs from the preceding in that the zoëcia are armed with lateral vibracula instead of avicularia.

There are two British species, both obtained from deep water.

1. *M. DUTERTREI*, *Audouin*.

*Flustra Dutertrei* (*Audouin*, *Savigny*), *Lepralia Woodiana* (*Busk*, *McA.*, *T. H.*), *L. aurita* (*Reuss*), *L. otophora* (*Manzoni*).

*Hab.*: Cornwall (*T. H.*), Shetland (*A. M. N.*).

The colonies are large. The zoëcia are oval, minutely punctured, with semicircular orifices, each having the usual sinus in the lower margin. There are five spines round the circular portion of the orifice, and on each side is a slender vibraculum. In some forms there is a row of distinct large punctures round the margin of each cell.

The ovicels are globular, punctured like the cells.

2. *M. HYNDMANNI*, *Johnson*.

*Lepralia Hyndmanni* (*G. J.*, *D. L.*, *Busk*, *McA.*), *Herentia Hyndmanni* (*Gray*), *Hippothoa porosa* (*Smitt*).

*Hab.*: Sana Island (*Hyndman*) Shetland (*A. M. N.*), Peterhead (*O. W. P.*).

This is a rare species found in deep water on the



Western Coast. It exhibits a variety of modifications of structure, sometimes having perfectly oval and plain cells, and at others having the cells rhomboidal and much punctured. It has the semicircular orifice and sinus characteristic of this and the preceding genus, and below the orifice on a prominent boss-like vibracular cell is a long vibraculum. Round the orifice of each zoecium is usually a broad collar-like expansion. This species was first dredged off the Coast of Sana Island, near Cantire, in Argyleshire, a coast which Dr. Landborough describes as being rich in algæ and zoophytes.

GENUS III. SCHIZOTHECA, *Hincks*. ( $\sigma\chi\iota\zeta\omega$ , I divide, and  $\theta\acute{\eta}\kappa\eta$ , a receptacle.)

*Zoecia* with a suborbicular primary orifice, the lower margin sinuated; the secondary orifice raised, tubular, notched in front. *Oecium* terminal, with a fissure in the front wall. *Zoarium* (in British species) adnate.—T. H.

The sinus in the lower margin of the orifice, which is a characteristic of the present family, is often concealed in this genus by a secondary opening which is tubular and armed with spines.

The generic name is derived from the fissured appearance of the oecia.

1. *S. FISSA*, *Busk*. Plate XXI. fig. 3.

*Lepralia fissa* (*Busk, McA.*).

Hab.: Cornwall, Devon (*T. H.*), Guernsey (*Ald.*).

The colonies are silvery-white in colour. The zoecia are ovately rhomboidal, regularly disposed. The orifice of each cell is tubular, with a distinct sinus in front, and is armed with six long spines. The avicularia

have long mandibles, and are borne on distinct interspaces. The ovicels are globular, with a large triangular fissure in the front wall.

2. *S. DIVISA*, *Norman*.

*Lepralia divisa* (*A. M. N.*).

Hab.: Channel Islands (*A. M. N.*).

This species is developed in white colonies. The zoecia are regularly disposed in straight lines with distinct interspaces. The lower margin of the orifice is cut into two or three denticles, giving it a waved appearance. Each cell is armed with six long spines. The ovicels are long and oval, with a narrow fissure running part way down the centre of each.

GENUS IV. *HIPPOTHOA*, *Lamouroux*. (*Hippothoa*, one of the Nereids.)

*Zoecia* distant, caudate, connected with one another by a slender prolongation of the lower extremity, so as to form linear series; branches given off from the sides of the cells; orifice subterminal, suborbicular, with the lower margin sinuated or produced. *Zoarium* adherent.—T. H.

In this genus "the cells are narrowed below into long tubular peduncles," and are so arranged as to develop in single linear series, with branches also in single series given off at right angles from the sides of the cells.

1. *H. DIVARICATA*, *Lamouroux*. Plate XXI. fig. 4.

*Catenicella divaricata* (*De Bl.*), *H. lanceolata* (*Gray*, *Hassall*, *G. J.*, *R. Q. C.*), *H. Patagonica* (*Busk*), *Mollia hyalina* formâ *divaricata* (*Smitt*), *H. longicorda* (*Fischer*).



Hab.: Generally distributed.

The cells are ovate, very small, and of a pearly-white colour, extended below to a slender thread which connects each cell with the one next to it. It has been called by Mr. Couch, "the Smaller Beaded Coralline." The branching takes place in a single series at right angles to the cells, and in every case commences from the centre of a cell. In one variety, however, to which the name "*conferta*" has been given, the cells are crowded together, and are not arranged in single series. This variety appears to be found always on seaweeds.

The cells are sometimes smooth, and at other times more or less distinctly crossed by transverse markings, and in the variety *conferta* there is a boss below the orifice of each cell.

2. *H. expansa*, Dawson.

Hab.: Off Unst (*C. W. P.*).

The cells are larger than in the preceding species, and are regularly transversely striated. *H. expansa* is a deep-water species, and is a native of the northern seas.

3. *H. distans*, MacGillivray.

*H. flagellum* (*Manzoni, Hincks*).

Hab.: Generally distributed.

The cells in this species are smaller than in *H. divaricata*. The species are also distinguishable by the shape of the orifice, that of the present being egg-shaped, whilst that of *divaricata* is semicircular, with a notch in the lower margin. The colonies of this species have a perfectly dendritic mode of growth, in single series, and the tubular expansions of the cells are very long.

This species is described by Mr. Hincks (*B. M. P.*,

293), as *H. flagellum*, but in the A. M. N. H. for July, 1881, he withdraws that name and substitutes the one given above.

Mr. Hincks describes by reference merely a species, *H. cassiterides* (Couch), which he regards as very doubtful. It is included in the lists of Couch, Johnston, and Landsborough.

GENUS V. RHYNCOPEA, *Hincks*. (ῥύγχος, a beak.)

*Zoecia* with the primary orifice transversely elliptical, lower margin slightly sinuated, secondary orifice sub-orbicular, with a mucro on the lower margin, and an uncinat process immediately above it, within the mouth. *Zoarium* incrusting.—T. H.

1. *R. BISPINOSA*, *Johnston*. Plate XXI. fig. 5.

*Lepralia bispinosa* (*G. J.*, *D. L.*, *T. H.*, *Busk*, *McA.*),  
*Discopora bispinosa* (*Gray*).

Hab.: Berwick Bay (*G. J.*), South Devon, Guernsey (*T. H.*), Shetland (*A. M. N.*).

This species forms lilac-coloured colonies. The cells are ovate, punctured round the margin, and granulated. The orifice is rounded, "within the lower margin a curved hook-like process, and immediately below it a tall, sharply pointed mucro." The upper margin of the orifice is pointed, and bears two long spines.

Sometimes there are large avicularia placed transversely across the cells.

The ovicels have a prominent boss on the front. These characteristics vary greatly with age and situation, this being one of the most variable forms known. Its position amongst the *Myriozoidæ* is to a large extent tentative, as its peculiar orifice allies it with the *Escharidæ*.

FAMILY XIV. ESCHARIDÆ, *Smitt.*

*Zoarium* calcareous, incrusting, or erect and lamellate, or ramose. *Zoecia* without a membranous area or raised margins: (a) with a simple primary aperture, horse-shoe-shaped, or semi-elliptical, or suborbicular; or (b) with an elevated secondary orifice inclosing an avicularium; or (c) with a primary orifice having a dentate lower margin, and a secondary orifice channelled in front or entire; or (d) with the lower margin elevated into a mucro; in all cases destitute of a true sinus and special pores.—T. H.

(a) *With a simple primary orifice.*

GENUS I. LEPRALIA, *Johnson* (in part). (λέπρα, scurf; ἄλιος, marine.)

*Zoecia* usually ovate, with the orifice more or less horseshoe-shaped, arched above, contracted at the sides, and with the lower margin entire and generally slightly curved outwards. *Zoarium* (in the British species) incrusting, or rising into foliated expansions composed of one or two layers of cells.—T. H.

1. *L. PALLASIANA*, *Moll.* Plate XXI. fig. 6.

*Eschara* *Pallasiana* (*Moll.*), *Cellepora* *Pallasiana* (*Lamx.*), *Flustra* *Hibernica* (*Hassall*), *Lepralia* *Pedilostoma* (*Hassall*).

*L. Pedicostoma* (*G. J., D. L.*), ? *L. Fenestralis* (*R. Q. C., D. L.*).

Hab.: "The predominant littoral species on the South-Western Coast of Devon," Llandudno, Isle of Man (*T. H.*), Hastings (*A. S. P.*), Tenby (*Busk*), Northumberland (*Alder*), Shetland (*A. M. N.*).

This is a very pretty species, incrusting stones and



sometimes shells in shallow water. The zoecia are oval, and are punctured all over in a curious manner, the interspaces between the punctures taking, in oldish specimens, the form of ridges running irregularly down the cell, often crossed by similar transverse ridges. The margin of the orifice is plain, but raised into a distinct collar or *peristome*, which sometimes projects considerably above the zoarium. There is frequently an umbo below the orifice, also an avicularium. The ovicels are "shallow, semi-lunate, closely inserted in the cell above" (*Hincks*, A. M. N. H., July, 1880).

2. *L. CANTHARIFORMIS*, *Busk*.

Hab.: Shetland (*Barlee*).

Described by Mr. Busk in the Q. J. M. S., viii. (1860), 143, under this name, and by the Rev. A. M. Norman, in an article on the Shetland Polyzoa in the Brit. Assoc. Report for 1868, as a variety of the preceding species.

The cells are broader than in *L. Pallasiana*, and are granulated; but it is not improbably a deep-water variety of that species.

3. *L. FOLIACEA*, *Ellis and Solander*. Plate XXII. fig. 3.

*Eschara fascialis* (*Pall.*, *Moll.*, *M.-Edw.*, *G. J.*, *D. L.*), *E. retiformis* (*Ray*, *D'Orb.*, *Flem.*), *E. bidentata* (*M.-Edw.*), *E. à bandelettes* (*De Bl.*), *E. foliacea* (*Lamk.*, *M.-Edw.*, *De Bl.*, *Stark*, *R. Q. C.*, *G. J.*, *D. L.*, *Busk*, *Heller*, *Manzoni*), *Porus cervinus* (*Ellis*), *Millepora tænalis* (*E. and S.*), *M. foliacea* (*E. and S.*, *Turt.*, *Stew.*, *Hogg*), *M. fascialis* (*Linn.*, *Stew.*, *Turt.*), *Cellepora lamellosa* (*Esper*).

Hab.: Isle of Wight (*Ellis*), South Devon, Ilfracombe (*T. H.*), Isle of Man (*Brown*), Hebrides (*A. M. N.*).

This is the "Stony Foliaceous Coralline" of Ellis,

and grows often to a large size. Dr. Johnston describes it as occasionally reaching a height of 3 or 4 inches, and being 12—20 in diameter; but Mr. Couch states that this is small compared with many specimens procured on the Cornish coast. He mentions one specimen which he had seen, which measured 7 ft. 4 in. in circumference, and  $1\frac{3}{4}$  ft. in depth. This was obtained near Eddystone Lighthouse. This zoophyte grows in large foliaceous masses, "resembling a piece of paper in various folds which unite so as to form cavernous passages through the mass." The zoecia are arranged on both sides of the folds back to back as in *F. foliacea*. They are usually recognizable only as round openings quincuncially arranged. In their young stage they are punctured, the punctures becoming deeper and more furrowed with age. When living the zoarium is flesh-coloured; but the colour changes to brown on removal from the water. It is sometimes found as an incrusting species, in which case the cells are, of course, unilateral.

4. *L. ADPRESSA*, Busk. Plate XXI. fig. 7.

*L. lata* (Busk, Manzoni).

Hab.: Torbay (T.H.), Guernsey (A.M.N.), Hastings (Miss Jelly).

The cells are oval, indistinctly dotted. The orifice is long, with a straight lower margin and oval above; on each side of the orifice, just above the lower margin, there is a distinct contraction. The margin of the orifice is thickened, and on each side of it is occasionally a knob or boss.

The colonies are chiefly found incrusting shells of univalves.

5. *L. PERTUSA*, Esper.

*Cellepora pertusa* (*Esper*), *C. perlacea* (*Thompson*),  
*Escharina pertusa* (*M.-Edw.*), *E. perlacea* (*M.-Edw.*),  
*Escharella pertusa* (*Smitt*).

Hab.: Isle of Man (*Forbes*), Cornwall (*C. W. P.*),  
 South Devon, Guernsey (*T. H.*), Sana Island (*Hynd-*  
*man*), Shetland (*A. M. N.*).

This species occurs in orange-coloured colonies incrusting rocks and shells. The zoecia are ovate, punctured, distinct, each with a somewhat circular orifice, the margin of which is thickened and without spines. Sometimes there is an umbo or tubercle below the orifice. The orifice is narrowed just above the lower margin by two projecting denticles.

6. *L. HIPPOPUS*, *Smitt*.

Hab.: Coast of Northumberland (*Alder*).

The locality named is that of the only British specimen of this species which has been noticed.

7. *L. EDAX*, *Busk*.

*Cellepora edax* (*Busk*, *Hincks*).

Hab.: Plymouth, Guernsey (*T. H.*).

This species is found incrusting the shells of univalve molluscs, into which it has the power of eating, so as to ultimately remove the entire shell, "its own zoarium supplying a good and solid substitute for the house which it has supplanted."—*Hincks*.

The colonies are red in colour, and the separate zoecia are irregularly shaped and arranged. The margins are punctured, and below the orifice is a boss or umbo. The surface of the cell is striated. The orifice is rounded, contracted in the middle, with a slightly curved lower margin.

The avicularia are placed on distinct areas between the cells.



8. *L. POLITA*, *Norman*.Shetland (*A. M. N.*).

This species forms pinkish-coloured colonies in deep water. The surface of the zoecia is smooth and polished. The orifice is long and arched, with a straight margin and much-developed *peristome*.

GENUS II. *UMBONULA*, *Hincks*.

*Zoecia* with the primary orifice suborbicular or sub-quadrangular, lower margin slightly curved inwards; peristome not elevated, no secondary orifice; a prominent umbo (?avicularian cell) immediately below the mouth, supporting an avicularium. *Zoarium* (in the British species) incrusting.—*T. H.*

1. *U. VERRUCOSA*, *Esper*.

? *Cellepora verrucosa* (*Esper*), *Lepralia verrucosa* (*Thompson*, *G. J.*, *Alder*, *D. L.*, *Busk*, *McA.*, *Heller*), *Discopora verrucosa* (*Gray*).

*Hab.*: Devon, Cornwall, Guernsey (*T. H.*), Scarborough (*Bean*), Northumberland (*Alder*), St. Andrews (*McI.*), Wick (*C. W. P.*), Scotland (*D. L.*), Shetland (*A. M. N.*).

This species forms incrusting colonies of a rose-red colour. The cells are very thin and friable, except when occurring in deep water. The cells are convex, having a distinct umbo just below the orifice. From this umbo ridges radiate to the margin of the cell. There is usually an avicularium below the umbo.

These characteristics are all intensified in the deep-water varieties, in which also the ovicels are prominent, and decorated with punctures and spines so as to form a "very handsome crest."

(b) *With a raised secondary orifice.*

GENUS III. PORELLA, Gray.

*Zoecia* with the primary orifice semicircular; secondary (or adult) orifice elongate, inversely subtriangular or horseshoe-shaped, inclosing an avicularium, usually with a rounded mandible. *Zoarium* incrusting, or erect; foliaceous, with a single layer of cells, or ramose.—T. H.

This genus comprises some species which are incrusting, and others which are erect and branching: the first and second species are of the former type.

1. *P. CONCINNA*, Busk.

*Lepralia concinna* (Busk, *McA.*, *Hincks*), *L. aperta* (Boeck), *L. Belli* (Dawson).

Hab.: Widely distributed.

The colonies are circular, and of a red colour. The zoecia vary considerably, but are all distinguishable by the orifice, which is arched, contracting towards a straight lower margin. Round the orifice the cell wall often forms a distinct thickened shoulder, and inside is a broad denticle. The surface of the zoecia is usually plain, with punctures round the margin; but in some varieties the punctures extend over the entire area.

2. *P. MINUTA*, Norman.

*Lepralia minuta* (A. M. N.).

Hab.: Shetland, Guernsey (A. M. N.), Wick (C. W. P.), Hastings (*Miss Jelly*).

This species is, as its specific name implies, very small, and "forms small roundish patches." It very much resembles the preceding species, being distinguished by its smaller size, and the regular linear arrangement of the cells.



3. *P. STRUMA*, *Norman*.

*Hemeschara struma* (*A. M. N.*).

This is a rare deep-water species, found by the Rev. A. M. Norman "about 25 miles north of the island of Unst." It forms yellowish glistening colonies, which rise "here and there into free frill-like expansions not exceeding half an inch in height, and consisting of a single series of cells."

4. *P. COMPRESSA*, *Sowerby*.

*Millepora cervicornis* (*Linn., Marsigli*), *M. compressa* (*Sowerby*), *Porus cervinus* (*Borlase*), *Cellepora cervicornis* (*Flem., G. J., D. L., R. Q. C., Busk, Sars., Alder*), *Eschara cervicornis* (*Busk, De Bl., D'Orb., Hincks*), *Porella cervicornis* (*Gray*), *Eschara stellata* (*C. W. P.*).

Hab.: Cornwall (*R. Q. C.*), Devonshire (*Coldstream*), Shetland (*A. M. N.*), Belfast Bay (*Thompson*).

This is a deep-water species, and is known as "the Stag's Horn Coralline." It grows to a height of about 3 inches, and forms branching zoaria of a flesh colour when living. The projecting zoecia give it a roughened appearance. The northern specimens appear to be more slender in habit than the southern ones.

The branches are truncate and flattened, from which circumstance the specific name is derived.

The zoecia are ovate and densely punctured.

5. *P. LÆVIS*, *Fleming*.

*Cellepora lævis* (*Flem., G. J., D. L., ? R. Q. C.*), *Eschara lævis* (*Sars., Alder, Smitt*), *E. lisse* (*De Bl.*), *E. teres* (*Busk*).

Hab.: Shetland, and more northern waters, ? Cornwall (*C. W. P.*).

This is a very deep-water species, and, with the exception of Mr. Couch (who states that it is common

in Cornwall), it does not appear to have been met with on British coasts, except in Shetland. Mr. Couch's *C. levis* was probably a dwarf form of *C. cervicornis*.

The present species has cylindrical branches, is yellowish in colour, with the lower portions of the zoarium highly polished, and grows to a height of about an inch. It is broad in proportion to its height, and is much subdivided. The zoœcia have a row of punctures round the margin.

GENUS IV. ESCHAROIDES, *Smitt.*

*Zoœcia* with the primary orifice suborbicular; *peristome* much elevated, and forming a secondary orifice, arched above, and with a sinus below, within which an avicularium is inclosed. *Zoarium* (in British species) erect, ramose.—T. H.

1. *E. ROSACEA*, *Busk.*

*Eschara rosacea* (*Busk*, *A. M. N.*).

Hab.: Loch Fyne (*A. M. N.*), Orkney (*Busk*).

This species grows to a height of  $\frac{1}{2}$  to  $\frac{2}{3}$  in., and rises from a short stem, dividing into a number of small branches which are either white or slightly tinged with rose colour. The branches are contorted and curved, and the zoœcia are convex, ovate, and granulated.

2. *E. QUINCUNCIALIS*, *Norman.*

*Eschara quincuncialis* (*A. M. N.*).

"Founded on a single specimen dredged in the Minch by the Rev. A. M. Norman, which was not more than a quarter of an inch long."

GENUS V. SMITTIA, *Hincks.*

*Zoœcia* with the primary orifice suborbicular, the

lower margin entire and dentate; *peristome* elevated and forming a secondary orifice, which is channelled in front; generally an avicularium below the sinus. *Zoarium* (in British species) either incrusting, or erect and foliaceous, the cells in a single or double layer.—  
T. H.

1. *S. LANDSBOROVII*, *Johnston*.

*Leprealia Landsborovii* (*G. J.*, *Busk*, *McA.*, *D. L.*, *T. H.*), *Eschara Landsborovii* (*Alder*), *L. crystallina* (*A. M. N.*), *Escharella Landsborovii* (*Smitt*), *E. pertusa* (*Smitt*).

Hab.: South Devon, Cornwall, Llandudno (*T. H.*), Hastings (*Miss Jelly*), Ayrshire (*D. L.*), Scarborough (*Bean*), Peterhead (*C. W. P.*).

This species occurs in two forms, one incrusting and of a white or reddish colour, and the other erect and rising to a height of 2 inches.

The walls are thin and hyaline, punctured round the margin, and sometimes thickly dotted over the entire surface. The *peristome* has a sinus or notch in its lower margin, in which an avicularium is generally placed.

The erect form is foliaceous, and presents a crumpled appearance, as if a number of small round papers were crumpled together one within the other.

2. *S. RETICULATA*, *McGillivray*.

*L. reticulata* (*Macgillivray*, *G. J.*, *D. L.*), *Escharina rimulata* (*D'Orb.*), *Reptescharella rimulata* (*D'Orb.*), *Escharella Legentilii* (*Smitt*).

Hab.: South Devon, Guernsey, Cornwall (*T. H.*), Northumberland (*Alder*), St. Andrews (*McI.*), Peterhead (*C. W. P.*).

This is a deep-water species forming silvery crusts



on stones and shells. The zoecia are elongately oval, with distinct margins from which short ribs proceed a little way towards the centre. There is a distinct peristome with a central sinus, below which is an oval avicularium. There are three spines on the upper margin of the orifice. The ovicels are rounded and covered with punctures.

3. *S. AFFINIS*, *Hincks*.

*Lepralia affinis* (*T. H.*).

Described by Mr. Hincks in *Dev. and Corn. Cat.*, *Ann. Nat. Hist.*, ser. 3, ix., 206, on the authority of a single specimen found by him at Start Bay, South Devon. The avicularium, instead of reaching longitudinally downwards from the sinus, as in the preceding species, is placed transversely just below it.

4. *S. CHEILOSTOMA*, *Manzoni*.

*Lepralia cheilostoma* (*Manzoni*).

Hab.: Guernsey, South Devon, Cornwall (*T. H.*), Hastings (*Miss Jelly*).

This zoophyte forms colonies of a red colour, turning dull white with age. The zoecia are elongately rhomboid, regularly dotted with punctures. The orifice is circular, with a peristome having a sinus in the lower margin, within which is a denticle or tooth. There are no avicularia. The ovicels are globose, with a raised areolated border.

5. *S. MARMOREA*, *Hincks*.

*Lepralia marmorea* (*T. H.*), ? *L. arrogata* (*Waters*).

Hab.: Cornwall (*T. H.*), Guernsey (*A. M. N.*).

This species much resembles the preceding, but has a row of distinct punctures round the margin of the zoecium, and an avicularium below the sinus of the peristome.

6. *S. BELLA*, *Busk*.*Lepralia bella* (*Busk, McA.*).Hab.: Shetland (*Barlee*).

Nearly related to *S. cheilostoma*. Described by Mr. Busk in the Q. J. M. S., viii. (1860), 144.

7. *S. TRISPINOSA*, *Johnston*. Plate XXI. fig. 8.

*Discopora trispinosa* (*G. J.*), *Berenicea trispinosa* (*G. J.*), *Lepralia trispinosa* (*G. J., T. H., Busk, McA., R. Q. C., Alder, D. L.*), *L. Jeffreysii* var. *a* (*A. M. N.*), *Escharella Jacotini* (*Smitt*).

Hab.: Berwick Bay (*G. J.*), Northumberland (*Alder*), Cornwall (*C. W. P.*), Aberdeen (*McGillivray*), Hastings (*Miss Jelly*), St. Andrews (*McI.*), South Devon, Isle of Man (*T. H.*).

This species forms yellowish crusts, which in aged specimens become thick and coarse, and "swell up at pretty regular intervals into little bosses or tubercles. The cells in these parts are irregularly heaped together, and often rise perpendicularly somewhat in the manner of a *Cellepora*."—*Alder*. In normal specimens the cells are more or less rectangular, with distinct raised margins. They are roughened with punctures, a row of which is also placed within the margin. There is a peristome with a "spout-like" sinus, and the orifice is armed with three long stout spines. The crusts are often "white in colour, but freckled with yellow."—*Couch*.

GENUS VI. *PHYLACTELLA*, *Hincks*. (*φυλακτὸς*,  
fortified.)

*Zoæcia* with a primary orifice more or less semi-circular, the lower margin usually dentate; peristome much elevated, not produced or channelled in front.

No *avicularia*. *Zoarium* (in British species) incrusting.  
—T. H.

1. *P. LABROSA*, *Busk*.

*Lepralia labrosa* (*Busk*, *T. H.*, *A. M. N.*), *Alysidota labrosa* (*Busk*).

Hab.: Shetland (*A. M. N.*), South Devon (*T. H.*), Hastings (*Miss Jelly*), Cornwall (*C. W. P.*).

This is a deep-water species. The cells branch in single or double series. They are oval, and thickly punctured. The orifice is semicircular, with three teeth on its lower margin, and with a prominent well-developed peristome around the front.

2. *P. COLLARIS*, *Norman*.

*Lepralia collaris* (*A. M. N.*).

Hab.: Guernsey (*A. M. N.*), Torbay, Isle of Man (*T. H.*), Hastings (*Miss Jelly*).

This species much resembles the preceding. It does not, however, branch in single series, but forms brownish patches. The zoecia are plain, and the orifice is destitute of the three denticles described as characterizing *P. labrosa*.

3. *P. EXIMIA*, *Hincks*.

*Lepralia eximia* (*T. H.*, *C. W. P.*).

Hab.: Cornwall (*C. W. P.*), Shetland (*A. M. N.*).

The colonies of this species incrust shells and stones, and spread in lobed patches. It is found in deep water. The peristome develops into "triangular expansions" on each side of the orifice. On the lower margin of the orifice are three small denticles.

(c) *With a mucronate peristome.*

GENUS VI. *MUCRONELLA*, *Hincks*.

*Zoecia* with a suborbicular or semicircular orifice;



the peristome elevated in front into a more or less prominent mucro. *Zoarium* (in the British species) incrusting.—T. H.

1. *M. PEACHII*, Johnston.

*Lepralia Peachii* (G. J., Gray, Busk, McA., Heller, D. L., Alder), *L. immersa* (G. J., D. L., R. Q. C.), *Berenicea flava* (G. J.), *B. immersa* (Flem.), *Escharella immersa* (Gray), *Discoporella coccinea* formâ *Peachii* (Smitt), *B. immergée* (De Bl.).

Hab.: Cornwall (C. W. P.), Sana Island (Hyndman), Ayrshire Coast (D. L.), Guernsey (T. H.), &c. Common.

This species somewhat resembles *Microporella ciliata*. It forms irregular incrustations of an amber colour. The zoecia are sometimes plain and at others granulated. The orifice is protected by a peristome prolonged into a mucro, and has five or six spines on the upper margin. The cells are immersed, which gives the colony a flat appearance. There is a variety (*octodentata*) in which there are eight marginal spines. The spines are very brittle, and are rarely found in aged specimens.

2. *M. VENTRICOSA*, Hassall.

*Lepralia ventricosa* (Hassall, G. J., Busk, McA., D. L., Manzoni, Alder), *L. arrecta* (Reuss), *Discopora coccinea* formâ *ventricosa* (Smitt).

Hab.: Northumberland (Ald.), Dublin Bay (Hassall), Irvine (D. L.), Newhaven (Dr. Greville), Sana Islands (Hyndman), Cornwall, Guernsey (T. H.).

This species has large, convex, distinct cells of a greyish-white or brownish colour. The cells are ovato-globose, with longitudinal lines of small dots or punctures extending down each cell from the orifice, which is circular, raised into a peristome, and armed



with four long spines on the upper margin, and a prominent mucro on the lower one. The cells are distinct from each other, and have a row of punctures on the margin.

The mucro is sometimes cleft in two, and the cells are arranged in linear series.

3. *M. VARIOLOSA*, Johnston. Plate XXII. fig. 2.

*Lepralia variolosa* (G. J., R. Q. C., Busk, McA., D. L.), *L. ovalis* (Hassall, D. L.), *L. serrulata* (Reuss), *L. tenera* (Reuss), *L. vinca* (R. Q. C.), *Escharella variolosa* (Gray).

Hab.: Universally distributed.

The colonies are of a yellowish flesh colour when living, changing on death to brown or sallow white, and sometimes to pure white. The zoecia vary considerably in appearance. They are ovate or rhomboidal in shape, with a distinct row of punctures or short transverse bars round the margins, which are slightly raised. The surface of each cell is also dotted with small punctures. The orifice is circular, with the peristome extended into a mucro, behind which is a denticle. There are two or three spines on the upper margin of the orifice. The ovicels are globose and granulated.

This is a deep-water species.

4. *M. LAQUEATA*, Norman.

*Lepralia laqueata* (A. M. N.), *Discopora coccinea* formâ *ovalis* (Smitt).

Hab.: Shetland (A. M. N.).

This is a deep-water species closely allied to the preceding. It is "reddish when living, and ivory-white when dead."

5. *M. ABYSSICOLA*, Norman.

*Lepralia abyssicola* (*A. M. N.*).

Hab.: Shetland (*A. M. N.*).

This again is a species found in deep water (140—170 fathoms). It forms "large white glossy irregular crusts on stones, &c." The cells are large and ovately rhomboidal, slightly granulated, with a prominent screen-like mucro in front of the orifice. There are two or three spines on the upper margin of the orifice.

6. *M. MICROSTOMA*, *Norman*.

*Lepralia microstoma* (*A. M. N.*).

Hab.: Shetland sea (*A. M. N.*).

Another deep-water species (80—140 fathoms), allied to the preceding species, but having the orifice of the zoecium borne on a short free neck-like extension of the cell.

7. *M. COCCINEA*, *Abildgaard*. Plate XXII. fig. 1.

*Cellepora coccinea* (*Abildgaard*, *Lamk.*, *Lamx.*), *Berenicea coccinea* (*Flem.*, *Lamx.*, *G. J.*), *Lepralia coccinea* (*G. J.*, *R. Q. C.*, *Alder*, *Busk*, *McA.*, *D. L.*), *L. tridentata* (*R. Q. C.*), *L. appensa* (*Hassall*), *L. Ballii* (*G. J.*, *D. L.*), *L. mamillata* (*Searles Wood*, *Busk*, *Manzoni*), *L. pteropora* (*Reuss*, *Manzoni*), *L. peregrina* (*Manzoni*), *Bérénice écarlate* (*De Bl.*), *Discopora appensa* (*Smitt*), *Escharina coccinea* and *Ballii* (*Gray*), *Distansescharellina pteropora* (*D'Orb.*).

Hab.: Common.

This has been called the "Crimson Cellepore," and forms roundish crusts on weeds, stones, and shells. The shade of colour varies from yellowish-brown to purple, becoming paler after death. "It varies in colour according to the locality where it grows."—*Couch*. The crusts extend over an area of one or even two inches in diameter.

The zoecia are subcylindrical, with distinct granulations all over the surface. The orifice has a peristome extending into a mucro in front, and armed with 4—6 spines on the upper margin. On each side of the orifice on the shoulder of the cell is a prominent avicularium. The ovicels are globose and granulated like the zoecia.

8. *M. PAVONELLA*, *Alder*.

*Eschara pavonella* (*Alder, Busk, McA., Smitt.*), *E. cribraria* (*Busk, R. Q. C.*), *Discopora pavonella* (*Smitt.*).

Hab.: Cullercoats (*Alder*), Scarborough (*Bean*), Dogger Bank (*T. H.*).

This species has two modes of growth. In one it forms large rounded incrustations, in the other it grows erect to the height of more than an inch. The cells are large and oval, with a circular orifice, on the lower margin of which is a blunt denticle. On each side of the orifice is an avicularium. The surface of the cell is smooth, with rib-like extensions from the margin towards the centre, the ribs enclosing dark markings near the margin.

GENUS VII. *PALMICELLARIA*, *Alder*. (*Palma*, the palm of the hand; *cella*, a cell.)

*Zoecia* with the primary orifice orbicular or ranging from semicircular to semi-elliptical; the peristome elevated around it, so as to form a secondary orifice, and carried out in front into a projecting palmate or mucronate process, with an avicularium on its inner aspect. *Zoarium* (in the British species) erect and ramose, or (?) lamellate.—*T. H.*

1. *P. ELEGANS*, *Alder*.



*Pustulipora proboscidea* (G. J., D. L., Gray, Busk, McA., M.-Edw.).

*Entalopora proboscidea* (D'Orb.).

Hab.: Zetland seas (Forbes), Loch Fyne, The Minch (A. M. N.).

This is an erect species growing to a height of  $\frac{1}{2}$  in. It is "ivory-white in colour, and very elegant." It is slightly branched. The cells are alternate, and arranged back to back in four series, giving the zoophyte a quadrangular appearance. They are plain, without spines or ornament; the orifice is circular, borne upon a neck-like extension of the cell, and has a curved mucro in front. It is a deep-water species (80—90 fathoms).

2. *P. SKENEI*, Ellis and Solander.

*Millepora Skenei* (E. and S., Turt., Stew.), *Cellepora palmata* (Flem.), *C. Skenei* (G. J., R. Q. C., D. L., Busk, McA., Alder), *Eschara Skenei*, var. *tridens* (Busk, Sars.), *Lepralia bicornis* (Busk), *Discopora Skenei* (Smitt), *E. palmata* (De Bl.).

Hab.: Aberdeen (Skene), Zetland (Flem.), Wick (C. W. P.), St. Andrews (McI.), Northumberland (Alder), Oban, Torbay (T. H.), Cornwall (C. W. P.).

This species grows to a height of  $\frac{1}{2}$  an inch to an inch, and is of a yellow or red colour. It is a deep-water species, and rather rare.

It is dichotomously branched, and the branches are short, palmate, and truncated. The cells are arranged somewhat spirally. The orifice is much elevated, and has a long prominent mucro on the lower lip. "The shape and arrangement of the cells give them a resemblance to a fir-cone in which the scales are loosely arranged."—Couch.

There is a variety (*Foliacea*) of this species in which the zoarium extends in a foliaceous manner, resembling that of *Retepora*.

3. *P. LOREA*, *Alder*.

*Eschara lorea* (*Ald.*, *A. M. N.*).

Hab.: Shetland (*Barlee*, *A. M. N.*).

This is another deep-water species, which grows erect to the height of 1 to 1½ inches. It very much resembles the preceding, with which it has been considered identical.

4. *P. (?) CRIBRARIA*, *Johnston*.

*Eschara cribraria* (*G. J.*, *D. L.*, *Alder*).

Referred provisionally to this genus, but considered by Dr. Johnstone and others as a form of *M. pavonella*.

#### GENUS VIII. RETEPORA, *Imperato*. (*Rete*, a net.)

*Zoecia* disposed on the front surface of an erect and ramose zoarium, the branches of which usually inosculate, and form a reticulate expansion; orifice semicircular or semi-elliptical, with a prominent rostrum on the lower margin, bearing an avicularium. *Zoarium* adherent by means of an incrusting base, composed in great part of aborted cells; avicularia developed on both the back and front of the zoarium.—T. H.

In the British species of this genus the zoarium forms reticulated foliaceous expansions.

1. *R. BEANIANA*, *King*. Plate XXII. fig. 4.

*Millepora cellulosa* (*Jameson*, *Linn.*, *Turt.*, &c.), *M. retepora* (*Pallas*), *R. cellulosa* formâ *Beaniana* (*Smitt*), *Eschara Beaniana* (*Smitt*), *R. dentelle de mer* (*De Bl.*), *R. reticulata* (*D. L.*).

Hab.: Northumberland (*King*, *Alder*, &c.), Peterhead

(*C. W. P.*), Scarborough (*Bean*), Shetland (*A. M. N.*), North Sea (*A. S. P.*).

This zoophyte grows to a height of about an inch, and rises from a cup-like stalk by which it is affixed to shells and stones. It attains a breadth of one to two inches, and expands in a foliaceous manner. It is reticulated all over. "A person might think it was a piece of Honiton lace which had lost its pliancy by being frozen."—*Landsborough*. The cells occur on the upper or inner side, and are rounded. The orifice is extended into a peristome having a short projection bearing an avicularium. The reticulations or *fenestrae* are oval. The back or outer side of the zoarium is "traversed by raised white lines." Above each *fenestra* is a small avicularium.

2. *R. Couchii*, *Hincks*.

(The *R. Beaniana* of *Hincks*, *A. N. H.*, ser. 3, ix., 308.)

Cornwall (*R. Q. C.*), Devon (*T. H.*), Guernsey (*A. M. N.*).

This is a much smaller species than the preceding, and is a southern form. It does not much exceed  $\frac{1}{2}$  in. in size, and is roughened by the projecting beaks of the peristomes. Both this and the preceding are deep-water species.

#### FAMILY XV. CELLEPORIDÆ.

*Zoæcia calcareous*, more or less vertical to the plane or axis of the colony, irregularly heaped together, with a terminal orifice.—*T. H.*

GENUS CELLEPORA, *Fabricius* (in part).

*Zoæcia urceolate*, erect or suberect, heaped together and irregularly disposed; the orifice terminal, with

one or more ascending rostra in connection with it, bearing avicularia. *Zoarium* incrusting, often composed of many layers of cells, or erect and ramose.—T. H.

1. *C. PUMICOSA*, *Linncæus*.

*Cellepora verrucosa* (*Linn., Fabr.*), *C. spinosa* (*Turt.*), *Millepora pumicosa* (*Pallas, E. and S., Stew.*), *Madrepore verrucaria* (*Esper*).

Hab.: Common. On stems of hydroids and algæ.

This is the "Porous Eschara" of Ellis, and the "Pumice-stone Coral" of Couch. It forms a porous, friable, calcareous mass generally occurring in small patches varying in colour, sometimes pinkish, sometimes dirty white. The zoecia are oval, but vary according to the substance which the zoophyte is incrusting. They are smooth, and have a circular terminal orifice, with a large rostrum in front bearing an avicularium.

The polypide is orange-coloured.

2. *C. RAMULOSA*, *Linncæus*. Plate XXI. fig. 9.

*Cellepora pumicosa* var. (*Sars.*), *C. rameux* (*De Bl.*).

Hab.: Cornwall, Devon (*T. H.*), Hastings (*Miss Jelly*), St. Andrews (*McI.*), Shetland (*A. M. N.*).

This species, called by Couch the "Branched Cellepore," grows to a height of two or three inches, and "resembles foreign corals in miniature." While living it is flesh-coloured, changing to white on death. The branches are short and stout, and roughened by the projecting rostra of the zoecia. The cells are smooth and tubular. The orifice is produced into a large pointed rostrum bearing an avicularium.

The polypide is flesh-coloured.

This is a rather deep-water species, and is found on the stems of *Sertulariæ*, &c.



3. *C. DICHOTOMA*, *Hincks*.

*C. attenuata* (*Alder*), *C. avicularia* (*Smitt*).

Hab.: South Devon, Oban (*T. H.*), Northumberland (*Alder*), St. Andrews (*McI.*), Wick (*C. W. P.*).

This species grows erect to the height of about an inch, and is found in deep water on other zoophytes.

The cells are ovate and convex. Below the orifice is a rostrum or projection, with an avicularium beside it. Other avicularia are scattered about the colony. The ovicels are globose, with distinct punctures.

The zoaria are "dichotomously branched with great regularity." A variety of this species (*attenuata*) is recognized, which has the zoarium slender and of uniform thickness.

4. *C. AVICULARIS*, *Hincks*.

Hab.: South Devon, Cornwall, Oban (*T. H.*), St. Andrews (*McI.*), Shetland (*A. M. N.*).

In this and the following species of this genus, an erect growth is not attained, the zoaria being incrusting.

This varies in shape according to the object upon which it is developed. The zoecia are irregularly placed, sometimes growing one on the top of another. The different cells are ovate and punctured round the margin, and the orifice is developed in its lower margin into a pointed sinus, on one side of which are a rostrum and an avicularium. There are also scattered avicularia on other parts of the colony.

5. *C. TUBIGERA*, *Busk*.

Hab.: South and West Coasts of Britain (*Busk*), Arran (*West*).

Described by Mr. Busk (*Crag Polyzoa*, 60).

6. *C. ARMATA*, *Hincks*.

Hab.: Hastings (*Miss Jelly*), Cornwall (*T. H.*).

This is probably a deep-water species. The cells are large and ovate, without spines or punctures. The orifice is circular, and somewhat pointed. On each cell is a rostrum and an avicularium, and avicularia are freely scattered about the colony.

7. *C. COSTAZII*, *Audouin*.

*C. bimucronata* (*Hassall*), *C. Hassallii* (*Busk, McA., Manzoni, Alder*), *Lepralia Hassallii* (*G. J., D. L.*), *Celleporina Hassallii* (*Gray*), *Celleporaria Hassallii* (*Smitt*).

Hab.: Cornwall, Devon, Isle of Man (*T. H.*), Ayrshire (*D. L.*), The Minch (*A. M. N.*), Bamborough (*Alder*), Peterhead (*C. W. P.*).

This species forms thick crusts on zoophytes, seaweeds, &c. The cells are often superimposed. They are large and cylindrical. The orifice is wide, with a sinus on the lower margin, and "an erect tubular process on each side bearing a small avicularium." The ovicels "mimic the swollen lobes of the flower of a calceolaria."—*Johnston*.

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## SUB-ORDER II.: CYCLOSTOMATA.

### FAMILY I. CRISIIDÆ.

*Zoarium dendroid, calcareous, composed of segments united by corneous joints. Zoæcia tubular, disposed in one or two series.*—*T. H.*

GENUS I. *CRISIA*, *Lamouroux* (part). (From *Crisia*, a daughter of Oceanus.)

*Zoæcia* in a single series, or in two alternate series.—*T. H.*

1. *C. CORNUTA*, *Linnæus*. Plate XXII. fig. 5.

*Sertularia cornuta* (*Linn.*, *Esper*, *Berk.*), *Cellularia falcata* (*Pallas*), *C. cornuta* (*Brugière*), *Cellaria cornuta* (*E. and S.*, *Lamk.*), *Eucratea cornuta* (*Lamx.*, *Flem.*, *Temp.*, *Cuvier*), *Falcaria cornuta* (*Oken*), *Eucratea appendiculata* (*Lamx.*), *Unicellaria cornuta* (*De Bl.*), *U. appendiculata* (*De Bl.*), *Crisidia cornuta* (*M.-Edw.*, *G. J.*, *D. L.*, *P. H. G.*, *Ald.*, *A. M. N.*, *D'Orb.*, *Busk*), *C. setacea* (*D. L.*, *R. Q. C.*, *G. J.*), *C. geniculata* (*M.-Edw.*, *G. J.*, *P. H. G.*, *D. L.*, *Sars.*), *Filicrisia geniculata* (*D'Orb.*).

Hab.: Cornwall (*R. Q. C.*), South Devon, Ilfracombe, Filey, Oban (*T. H.*), Northumberland (*Alder*), Shetland (*A. M. N.*), Menai Straits, Jersey (*A. S. P.*).

This is the "Goat's-horn Coralline" of Ellis, who says: "This very small capillary coralline consists of branches of single cells, shaped like goat's horns inverted, placed one above another, on the top of which is a small circular opening which inclines inwards. At the back is a fine upright hair near the insertion of the cell next above it." It grows in slender tufts to a height of  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch. The cells are placed in single series and are curved, as shown in the plate. A variety (*geniculata*) occurs in which the cells bend alternately in opposite directions. The ovicels are oval, dotted with specks. The zoecia are sometimes punctured, and at other times entirely without markings.

2. *C. EBURNEA*, *Linnæus*. Plate XXII. fig. 6.

*Sertularia eburnia* (*Linn.*, *Jameson*, *Esper*, *Berk.*, &c.), *Cellularia eburnia* (*Pallas*, *Hogg*, *Brugière*), *Cellaria eburnia* (*E. and S.*, *Lamk.*, *G. J.*), *Crisia aculeata* (*Hassall*, *G. J.*, *Busk*), *C. Haueri* (*Reuss*), *C. ivoire* (*De Bl.*).

Hab.: Generally distributed. Blackpool, Menai Str., Seascale, Jersey (*A. S. P.*).

This is the "Tufted Ivory Coralline" of Ellis, and is very easily distinguishable by its whiteness and brittleness. The zoecia are alternate and arranged in internodes of 3—9, or 11 (rarely more than 7) cells. The cells are speckled, and form very pretty objects under the lens. This zoarium is often much branched, the branches usually arising from one of the lowest (usually *the* lowest) cells in an internode. The ovicels are pyriform and densely punctured. Arising from the zoecia are occasionally long tubular extensions which appear to serve the purpose of radical tubes, and to act as modes of attachment. The zoophyte grows to a height of  $\frac{1}{4}$  to 1 inch, and is generally found parasitic on other zoophytes, particularly *H. falcata* and *F. foliacea*.

### 3. *C. DENTICULATA*, Lamarck.

*Cellaria denticulata* (*Lamk.*), *Crisia luxata* (*Flem., De Bl., R. Q. C., G. J.*).

Hab.: Generally distributed.

This has been called the "Black-jointed Coralline." —*Couch*. It differs from the preceding by its erect and stiff mode of growth and straight branches, by the length of the internodes, and by the jet-black joints at the nodes. The internodes usually contain 11—16 cells, which are adnate throughout almost their entire length, and are speckled. The oecia are oval and speckled.

Favourite habitats for this species are the roots of *Laminaria*, upon which it grows to the height of an inch or more.

The branches generally arise from about the centre

of the internodes. This feature also serves to distinguish this species from the preceding.

## FAMILY II. TUBULIPORIDÆ.

*Zoarium* entirely adherent, or more or less free and erect, multiform, often linear, or flabellate, or lobate, sometimes cylindrical. *Zoecia* tubular, disposed in contiguous series, or in single lines. *Oecium* an inflation of the surface of the zoarium at certain points, or a modified cell.—T. H.

### GENUS I. STOMATOPORA, Bronn. (στόμα, the mouth.)

*Zoarium* repent, wholly adnate, or free at the extremities, or giving off erect processes; simple or branched; branches more or less ligulate. *Zoecia* in great part immersed, arranged in a single series or in several, which take a linear direction or are very slightly divergent.—T. H.

#### 1. *S. GRANULATA*, Milne-Edwards.

*Alecto granulata* (M.-Edw., G. J., Busk, D. L.), *S. incrassata* (D'Orb.).

Hab.: Cornwall (R. Q. C.), North Devon (T. H.), Northumberland (Ald.), Wick (C. W. P.), Hastings (Miss Jelly), Weymouth (A. S. P.), St. Andrews (McI.), Coll Island (D. L.), Shetland (A. M. N.).

The cells in this species grow in single series upon shells and stones in deep water. They are speckled, and have a slightly projecting tubular orifice. The zoarium is branched dichotomously.

#### 2. *S. MAJOR*, Johnston.

*Alecto repens* (Wood, Busk), *A. major* (G. J., Busk, D. L., Ald.), *A. dichotoma* (D. L.), ? *Tubulipora trahens* (R. Q. C., D. L.).

Hab.: Guernsey (*A. M. N.*), Coll Island (*D. L.*), Sana Island (*Thompson*), Isle of Man (*T. H.*), Northumberland (*Alder*), Cornwall (*R. Q. C.*).

This species was discovered by Dr. Landsborough on a valve of *Pinna ingens*. He likened the young unbranched specimen to "a tear slowly trickling down the cheek, and swelling in its progress." The cells grow in 2—4 series, and have tubular free orifices. The colony is much branched dichotomously. The cells are generally free from dots or markings, but are occasionally minutely speckled.

3. *S. DILATANS*, *Johnston*.

*Alecto dilatans* (*G. J.*, *W. Thompson*, *D. L.*, *Alder*).

Hab.: Sana Island (*Hyndman*), Northumberland (*Alder*), Islay Island (*Lady E. Campbell*).

This is a deep-water species. The cells are placed in 1—4 series, and are tubular, white, and punctate, with raised orifices. The branches of the zoarium are fullest at the ends, where there are 7—8 in a row, and are "constricted at intervals."

4. *S. JOHNSTONI*, *Heller*.

*S. granulata* (*D'Orb.*), *Criserpia Johnstoni* (*Heller*).

Hab.: Guernsey (*T. H.*).

This species forms somewhat flabellate incrustations on shells and stones. The zoecia are uni- or bi-serial.

5. *S. EXPANSA*, *Hincks*.

Hab.: Isle of Man (*T. H.*).

"This species forms clavate incrustations on shells. The zoecia increase in number from one or two to seven or eight in width. They are irregularly distributed, densely covered with minute punctures, and free for a large portion of their length."

6. *S. INCURVATA*, *Hincks*.



*Tubulipora incurvata* (T. H.), *Alecto incurvata* (T. H.).

Hab.: Guernsey (A. M. N.), Hebrides (O. W. P.).

A deep-water species, about  $\frac{1}{4}$  inch in length. The zoecia are biserial, punctate, and free, and extend outwards at the oral orifices. Sometimes only a single row of cells is developed.

7. *S. DIASTOPORIDES*, Norman.

8. *S. COMPACTA*, Norman.

Two deep-water species from Shetland, described by the Rev. A. M. Norman in the Reports of the Brit. Assoc., 1866 (1867), 204, and 1867 (1868), 310. *S. diastoporides* is the largest British representative of this genus.

9. *S. INCRASSATA*, Smitt.

*Tubulipora incrassata* (Smitt), *Alecto retiformis* (T. H.).

Hab.: Salcombe, Cornwall (T. H.), Guernsey, Shetland (A. M. N.).

This species forms patches of incrustations on shells. The zoaria are white and much branched, the branches anastomosing so as to form reticulations. The zoecia are bi- or tri-serial, with the orifice erect and free.

10. *S. DEFLEXA*, Couch.

*Tubulipora deflexa* (R. Q. C.), *Pustulipora deflexa* (G. J., T. H., Busk, Johet, McA.).

Hab.: Cornwall (R. Q. C.), Wick (O. W. P.).

"Zoarium erect, cylindrical, with waved tubes projecting from all directions." It is white in colour, and dotted all over, and the zoecia are irregularly placed, and are uni- or bi-serial.

11. *S. FUNGIA*, Couch.

*Tubulipora fungia* (R. Q. C., Smitt, Busk, McA.), *T. penicillata* (G. J., D. L., Ald., T. H.).



Hab.: Cornwall (*R. Q. C.*), Torbay (*T. H.*), Wick (*C. W. P.*).

Calcareous, about  $\frac{1}{4}$  inch in height. Fungiform, spreading in irregular lobes. The cells are irregularly disposed and distant from each other. They open chiefly at the circumference of the lobes. The orifice is circular, with a slightly thickened margin. The erect portions of the zoarium are "the extremities of a creeping linear base."

12. *S. FASCICULATA*, *Hincks*.

Founded on a single example obtained by Hyndman off the coast of Antrim, probably from deep water. (See *Hincks*, *B. M. P.*, 441.)

GENUS II. *TUBULIPORA*, *Lamarck*.

*Zoarium* adnate or decumbent, or suberect, forming a variously shaped expansion, either entire or lobate, or branched. *Zoecia* tubular, partially free and ascending, arranged in divergent series.—*T. H.*

1. *T. LOBULATA*, *Hassall*.

Hab.: Dublin Bay (*Hassall*), Isle of Man, Torbay (*T. H.*), Hastings (*Miss Jelly*).

Forms dull purple incrustations on shells. The zoarium is often radially branched, the branches being short and lobed. The zoecia are short, punctate, and tubular. The orifice of each cell is slightly raised. Some observers have classed this as a form of *Idmonea serpens*, to be hereafter described.

2. *T. FLABELLARIS*, *Fabricius*.

*Tubipora flabellaris* (*Fabr.*), *T. verrucaria* (*M.-Edw., Heller, Hassall*), *T. phalangea* (*R. Q. C., G. J., T. H., D. L., Busk*), *Phalangella phalangea* (*Gray*), *Diastopora plumula* (*Reuss*).

Hab.: Cornwall (*R. Q. C.*), South Devon (*T. H.*), Ilfracombe (*P. H. G.*), Weymouth (*A. S. P.*), Shetland (*C. W. P.*).

"It is so like the Prince of Wales' Feather that you are disposed to write 'Ich dien' underneath."—*Landsborough*. In colour it is light purple or lilac, and forms lobed or flabellate incrustations on old bivalve shells. The cells or tubes are long and slender, and free throughout almost the entire length. The walls are punctured. It is an exceedingly pretty species, its distinct tubes being beautiful objects even under a lens of low power.

3. *T. FIMBERIA*, *Lamarck*.

*Tubipora serpens* (*Fabr.*, *D'Orb.*), *T. flabellaris* (*G. J.*, *D. L.*, *Busk*, *Ald.*, *T. H.*).

Hab.: Wick (*C. W. P.*), Northumberland (*Alder*), Shetland (*C. W. P.*).

The zoarium is fan-shaped, of a dull white colour, strongly wrinkled or ridged both upon the cells and in the space between them. The cells are horizontal throughout their entire length, and are free for a very short distance only. As will be seen from the localities named, this is a northern species.

GENUS III. *IDMONEA*, *Lamouroux*. (From *Idmon*, one of the Argonauts.)

*Zoarium* erect and ramose, or (rarely) adnate; branches usually triangular. *Zoecia* tubular, disposed on the front of the branches, ranging in parallel transverse or oblique rows on each side of a mesial line.—*T. H.*

1. *I. ATLANTICA*, *Forbes*.

*I. radians* (*Van Ben.*).

Hab.: Zetland Seas (*Forbes*), Hebrides (*A. M. N.*), Coll Island (*D. L.*), North Sea (*A. S. P.*).

The zoaria are erect, white, and dichotomously branched, growing to the height of about  $\frac{1}{2}$  inch. The branches taper at each end. The cells are tubular, 1—4 or 5 in each series, and are bent outwards from about the centre of each cell at right angles to the medial line of the zoarium.

2. *I. SERPENS*, *Linnaeus*. Plate XXII. fig. 7.

*Tubipora serpens* (*Linn.*, *Fabr.*, *Stew.*, &c.), *Millipora liliacea* (*Pallas*, &c.), *M. tubulosa* (*E. and S.*), *Tubulipora transversa* (*Lamk.*, *Lamx.*, *De Bl.*, *Fischer*, *Stark*, *G. J.*), *T. foraminulata* (*De Bl.*), *T. pourpre* (*De Bl.*), *T. serpens* (*Flem.*, *R. Q. O.*, *G. J.*, *Ald.*, *D. L.*, *Busk*), *Idmonea transversa* (*M.-Edw.*, *D'Orb.*), *Obelia tubulifera* (*Lamx.*, *M.-Edw.*).

Hab.: Generally distributed. Weymouth (*A. S. P.*).

This is the "Small Purple Eschara" of Ellis (*Cor.* 74). It grows to a length of about  $\frac{1}{2}$  an inch or a little more. It is branched dichotomously, and is of a purple colour. The zoecia are in rows, close to each other, the series being semi-alternate. The cells are generally free towards the extremities. They are minutely frosted and punctured. This is a very attractive species, and has been described and figured by most zoophytologists.

GENUS IV. ENTALOPHORA, *Lamouroux*.

*Zoarium* erect and ramose, rising from a more or less expanded base, composed of decumbent tubes; branches cylindrical. *Zoecia* tubular, opening on all sides of the branches.—*T. H.*

1. *E. CLAVATA*, *Busk*.

*Pustulipora clavata* (*Busk, C. W. P.*), *P. deflexa* (part *T. H.*).

Hab.: Penzance (*C. W. P.*), Torbay (*T. H.*).

Forms short erect zoaria, with clavate cylindrical branches. The zoecia are tubular, irregularly scattered round the branches, with their extremities free and bending outwards and upwards. They are marked with white punctures, and the extremities of the branches are described by Mr. Hincks as cellular in appearance.

GENUS V. DIASTOPORA, *Lamouroux* (in part). (From διάστημα, an interval.)

*Zoarium* adnate and crustaceous, or foliaceous, usually discoid or flabellate, less commonly irregular in form. *Zoecia* tubular, with an elliptical or subcircular orifice, crowded, longitudinally arranged, in great part immersed.—*T. H.*

1. *D. PATINA*, *Lamarck*.

*Tubulipora patina* (*Lamk., De Bl., G. J., D. L., P. H. G., R. Q. C.*), *Patinella verrucaria* (*Gray*), *P. patina* (*Busk, T. H.*), *Discosparsa marginata* (*D'Orb.*), *D. patina* (*Heller*), *D. verrucaria* (*Flem.*), *Madrepora verrucaria* (*Linn., &c.*), *Tubulipora bellis* (*Thompson*), *Millepora verrucaria* (*E. and S.*).

Hab.: Cornwall (*R. Q. C.*), South Devon (*T. H.*), Weymouth (*A. S. P.*), Northumberland (*Alder*), St. Andrews (*McI.*), Hebrides (*A. M. N.*), Isle of Man (*Mrs. Beever*), Yorkshire Coast (*Mrs. Gatty*).

This is the "Wart-like Coralline" of Couch. It appears as a calcareous snow-white, more or less circular saucer-shaped *lamina* extending beneath and beyond a central crowded zoarium, in which the cells are radially disposed, the innermost cells being closed and

immersed, the outer ones being erect, with free tubular extremities.

The disc measures about  $\frac{1}{4}$  in. across.

2. *D. OBELIA*, *Johnston*.

*Tubulipora obelia* (*G. J.*, *R. Q. C.*), *D. hyalina* (*Smitt*),  
*D. latomarginata* (*Smitt*).

Hab.: Generally distributed.

This species forms closely adherent crusts spreading irregularly, but with a tendency towards circular expansions. The zoecia are alternate, distinct, partially free and erect, divided by pale lines, with the orifices rounded and oblique. "A small adventitious tubule rises from the back of some of the cells."

It is a semitransparent species, and the centre of the colony is usually slightly raised.

3. *D. SAENIENSIS*, *Norman*.

Hab.: Guernsey (*A. M. N.*), Cornwall (*T. H.*),  
Hastings (*Miss Jelly*).

This species is distinguished from the preceding by the absence of the boundary-lines between the cells, which are regularly disposed in radial lines from the centre, and by the orifice of the zoecium being occasionally operculate. A small tubule, of doubtful purpose, projects from the upper part of the operculum.

It forms thick, milk-white incrustations on shells, &c., usually in deep water.

4. *D. SUBORBICULARIS*, *Hincks*.

*D. simplex* (*Busk, Smitt*).

Hab.: South Devon, Isle of Man (*T. H.*).

This forms "thin papyraceous orbicular colonies of  $\frac{1}{2}$  in. diameter, with the zoecia deeply immersed." The orifice of the zoecium is elliptical, and projects just above the surface. The zoecia are densely punc-



tured. The ovicels are arranged round the zoarium, and are ovate with a tubular orifice.

### FAMILY III. HORNERIDÆ.

*Zoecia opening on one side only of a ramose zoarium, never adnate and repent.*—T. H.

#### GENUS I. HORNERA, Lamouroux.

Named after Mons. Horner.

*Zoarium* erect, ramose, sometimes reticulate. *Zoecia* tubular, opening on one side only of the branches, disposed in longitudinal series, the celliferous surface often traversed by wavy anastomosing ridges. *Oecium* a distinct chamber (not a mere irregular inflation of the surface of the zoarium), placed dorsally or in front.—T. H.

##### 1. H. LICHENOIDES, Linnæus.

*Millepora lichenoides* (Linn., Müll., Esper, Fabr.), *Hornera frondiculata* (Sars., Busk), *H. borealis* (Busk, Alder).

Hab.: Shetland, Hebrides (A. M. N.).

This is a northern form, in which the zoaria are erect and rise to a height of about an inch. The branches divide dichotomously, and form fan-shaped segments. The front surface is reticulately marked, and is also punctured. The zoecia open on the front and sides of the branches with circular orifices; those on the front are almost entirely immersed, those on the sides project slightly in a tubular manner. The back of the zoarium is marked by waved lines.

##### 2. H. VIOLACEA, Sars.

*Pustulopora Orcadensis* (Busk).

Hab.: Shetland (A. M. N., C. W. P.).

This species differs from the preceding in colour, being tinged with violet. It also lacks the reticular markings of *H. lichenoides*, and has the zoecia longer and more crowded. The ovicels are placed in the axils of the branches, and are punctate.

#### FAMILY IV. LICHENOPORIDÆ.

*Zoarium* discoid, simple or composite, adnate, or partially free and stipitate. *Zoecia* tubular, erect or suberect, disposed in more or less distinct series, which radiate from a free central area; the intermediate surface cancellated or porous.—T. H.

GENUS I. LICHENOPORA, Defrance. (From *λειχήν*, *lichen*.)

*Zoarium* discoid, raised, simple or composed of many confluent discs, entirely adnate, or partially free, and sometimes stipitate, developed on a thin lamina, which usually forms a border round it. *Zoecia* distinct or connate, in single radiating lines, or multiseriate.—T. H.

1. *L. hispida*, Fleming. Plate XXII. fig. 8.

*Discopora hispida* (Flem., De Bl., Hassall, G. J., R. Q. C.), *Tubulipora hispida* (G. J., D. L.), *Discoporella hispida* (Gray, Busk, Smitt, Sars, Alder, A. M. N.), *Discocavea aculeata* (D'Orb.), *Heteroporella hispida* (T. H.), *Tubulipora orbiculus* (Lamk., De Bl.).

Hab.: Guernsey, Devon, Cornwall (T. H.), Northumberland (Alder), St. Andrews (McI.), Weymouth, Shetland (A. M. N.).

This species forms white, calcareous, and very solid-looking crusts from  $\frac{1}{2}$  to  $\frac{3}{4}$  in. in diameter. The crust is sometimes very thick, and looks "like a piece of embossed velvet."—Couch. The zoecia are tubular, arranged in radiating series. The orifices are promi-



ment, with one large and two smaller teeth. The surface of the colony is often mamillated.

A variety of this species (*meandrina*) occurs in which a number of confluent colonies are united together.

2. *L. RADIATA*, Audouin.

*Melobesia radiata* (Savigny, Audouin), *Tubulipora patina* (M.-Edw.), *Unicavea radiata* (D'Orb.), *Discoporella flosculus* (T. H.), *D. radiata* (Busk), *Discosparsa patina* (Heller).

Hab.: South Devon (T. H.).

This species forms circular convex colonies about  $\frac{1}{8}$  in. in diameter. The zoecia are arranged in rays of alternately long and short tubes, and project with more or less mucronate orifices above the surface of the zoarium. Between each row of cells and the one next to it is a row of pores which is sometimes double.

3. *L. VERRUCARIA*, Fabricius.

*Madrepora verrucaria* (Fabr.), *Discoporella verrucaria* (Smitt, Busk).

Hab.: Orkney (Barlee), Arran (Busk).

This is a northern species, and is distinguished by its simple hemispherical zoarium. The cells are usually arranged in radiating lines, with an acuminate orifice which is sometimes bifid. The orifices project more and more as the cells near the margin of the colony. "The ovicel is a calcareous inflation often occupying the whole of the upper surface of the centre of the disc."

4. *L. REGULARIS*, D'Orbigny.

*Actinopora regularis* (D'Orb.).

Hab.: Shetland (A. M. N.).

A deep-water species. The zoecia are placed in rays tapering towards the centre, and around the margin is a cellular border sloping up towards the rays.

GENUS II. DOMOPORA, *D'Orbigny*. (From *dóμος*,  
a dwelling.)

*Zoarium* massive, cylindrical or mammiform, simple or lobed, formed of a number of subcolonies superimposed one upon the other; the whole surface porous. *Zoecia* disposed in radiating lines, consisting of one or more series, on the free extremity of the stem or lobes.—T. H.

1. D. STELLATA, *Goldfuss*.

*Tubulipora truncata* (*Flem.*, *G. J.*, *D. L.*, *De Bl.*), *Coronopora truncata* (*Gray*, *Busk*, *Smitt*), *Defrancia truncata* (*Sars*, *A. M. N.*), *Stellipora stellata* (*Hagenow*), *Ceriopora stellata* (*Goldfuss*), *Defrancia stellata* (*Reuss*, *Manzoni*, *Busk*), *Domopora truncata* (*Busk*).

Hab.: Shetland (*C. W. P.*, *A. M. N.*).

This is a deep-water species. The zoarium is erect, and bears a number of lobes on which the cells are arranged in radiating rows. The cells are punctate, and are arranged in 2 or 3 series.

2. D. TRUNCATA, *Jameson*.

*Millepora truncata* (*Jameson*), *Tubulipora truncata* (*G. J.*, in part).

This also is a deep-water species obtained by Mr. Peach and others from Shetland, and has often been considered a form of the preceding. It grows erect to the height of about  $\frac{1}{4}$  inch.

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SUB-ORDER III.: CTENOSTOMATA.

FAMILY I. ALCYONIDIIDÆ.

*Zoecia* more or less closely united, immersed in an expanded and adherent gelatinous crust, or forming an erect cylindrical or compressed zoarium; orifice closed

by the mere invagination of the tentacular sheath; not protected by external labia.—T. H.

GENUS *ALCYONIDIUM*, Lamouroux.

(From a supposed resemblance to the genus *Alcyonium*.)

*Zoecia* immersed or subimmersed; the orifice simple, papilliform. *Zoarium* gelatinous or argillaceous, either incrusting or erect.—T. H.

1. *A. GELATINOSUM*, Linnæus.

*Alcyonium gelatinosum* (Linn., Pall., E. and S., Lamæ., De Bl., Dalyell), *Ulva diaphana* (Sowerby, Lamk.), *Epipetrum gelatinosum* (Oken), *Alcyonidium diaphanum* (Lamæ., Gray, &c.), *Halodactylus diaphanus* (Farre, Van Ben.).

Hab.: Common.

This species is the "Sea Ragged Staff" of Ellis (Cor. 87), who states that it is called by the fishermen "Pipe-weed or Pudding-weed." He says: "This irregular shaped sily substance is found adhering to most kinds of marine substances, so that it frequently becomes troublesome to the fishermen by often clogging their nets." He failed in the first instance to recognize the nature of the substance described by him, and considered it "the spawn of some numerous species of shell-fish." "It is of a dark yellowish colour, and buncheth forth on everie side with unequal tuberosities or knots."—Johnson.

It grows to the height of several inches, and assumes various shapes. The zoarium is of a fleshy texture, and the cells are very numerous and closely arranged. The polypide has about 15 tentacles.

2. *A. HIRSUTUM*, Fleming.

*Alcyonium hirsutum* (Flem., G. J.), *Cycloum papil-*

losum (*Hassall, G. J., D. L., P. H. G., McA.*), *A. papillosum* (*Smitt*).

Hab.: Devon, Isle of Man, Filey, Oban (*T. H.*), Cullercoats (*Alder*), St. Andrews (*McI.*), Shetland (*A. M. N.*), Hastings (*Miss Jelly*), Menai Straits (*A. S. P.*).

This species forms incrustations on fuci and corallines. It is of a yellowish-brown colour, and is soft and fleshy. Sometimes it is found erect. The surface appears granular from the numerous papillæ which are scattered over it. It often forms palmate or lobed expansions, 5 or 6 inches long. It is said that "after being coated with ice, should they be immersed in sea water, the polypes will protrude their feelers and appear as active as if they had not been subjected to any such treatment."

3. *A. MAMILLATUM*, *Alder*.

Hab.: Northumberland (*Ald.*), Filey (*T. H.*).

"Incrusting, semi-transparent, brownish, covered with rather long, stout, and strongly wrinkled papillæ from which the polypides issue: occurs on old shells from deep water, which it envelops with a subcoriaceous crust, never rising to an erect state."—*Alder*.

4. *A. LINEARE*, *Hincks*.

Hab.: Dogger Bank (*T. H.*), Cullercoats (*Ald.*).

A deep-water species, with oval zoœcia with prominent orifices arranged in linear series.

5. *A. DISJUNCTUM*, *Hincks*.

Hab.: Unknown.

Named by Mr. Hincks (*Ann. N. H.*, ser. 4, xx., 217) on the authority of a single specimen from an unrecorded locality.

6. *A. MYTILI*, *Dalyell*.

*A. hexagonum* (*T. H.*, *Ald.*), *A. parasiticum* (*Smitt.*).

Hab.: Scotland (*Dalyell*), Devon and Cornwall, Menai Straits, Isle of Man (*T. H.*), Northumberland (*Ald.*).

A species not uncommon on stones and shells within and below tide-marks. It forms whitish or yellow incrustations. The zoecia are hexagonal, with distinct septa. The ova are opaque white, and arranged in a circle within the ovicels, which are numerous and scattered over the colony.

7. *A. ALBIDUM*, *Alder*.

Hab.: Northumberland (*Ald.*), Ilfracombe (*T. H.*).

This species is incrusting, and yellowish-white in colour; and in certain stages looks, according to Mr. Alder, "like a cluster of separate animals. The polypides are prominent, ventricose, flask-shaped, becoming erect towards the aperture, which is truncated when contracted."

8. *A. POLYUUM*, *Hassall*.

*Sarcophitum polyum* (*Hassall*, *D. L.*, *G. J.*, *McA.*).

Hab.: Dublin Bay (*Hassall*), Northumberland (*Ald.*).

Probably a form of *A. mytili*.

9. *A. PARASITICUM*, *Fleming*. Plate XXIII. fig. 1.

*Alcyonium parasiticum* (*Fleming*, *De Bl.*).

Hab.: St. Andrews (*McI.*), Northumberland (*Ald.*), Cornwall (*R. Q. C.*), Menai Straits, South Devon (*T. H.*).

This species becomes so impregnated with earthy matter as to resemble a blackish-brown coating of earth on corallines, hydroids, &c. It is about  $\frac{1}{10}$  inch in thickness.

Couch says the appearance so much approaches what is observed in many worms, as in *Sabellæ*, that he was inclined to think it the work of an annulated animal rather than that of a zoophyte.



## FAMILY II. FLUSTRELLIDÆ.

*Zoecia* immersed in a gelatinous crust; orifice bilabiate. Larvæ furnished with a bivalve shell.—T. H.

## GENUS FLUSTRELLA, Gray.

*Zoecia* immersed, the orifice bilabiate, with a movable lip, which acts as an operculum. Zoarium a gelatinous crust.—T. H.

1. *F. hispida*, *Fabricius*. Plate XXIII. fig. 2.

*Flustra hispida* (*Fabr., De Bl., G. J., D. L.*), *Alcyonium hispidum* (*G. J., P. H. G., Smitt*), *Flustra spongiosa* (*Templeton*), *Membranipora spongiosa* (*G. J.*), *Flustra carnosa* (*G. J., R. Q. C., Hassall, P. H. G.*), *Cycloum hispidum* (*Thompson*).

Hab.: Common.

The zoarium is gelatinous, and brown in colour. The zoecia are somewhat hexagonal, with the orifices "raised and bilabiate, bordered above and below by a thin horny rib, the lower one connected with a moveable lip which acts as an operculum."—*Hincks*. The colony bristles with long spines arranged round the zoecia. The polypide is very large, with 30—35 tentacles.

"When immersed in sea-water, first a very short white cylinder protrudes, and then the integument of the body unfolding like the inverted finger of a glove, displays the exterior of the animal, crowned by about thirty-five tentacles in campanulate arrangement. The form of the polypide is elegant, light, and beautiful. It rises very leisurely from the cell; but its retreat is most precipitate, vanishing in a moment."—*Dalyell*.

The development of the larva of this species, which

is enveloped in a "bivalve protective case," has been investigated by the Rev. Thos. Hincks, whose researches may be found in the Annals of Natural History for November, 1851 (ser. 2, viii., 357).

### FAMILY III. ARACHNIDIIDÆ.

*Zoecia* usually more or less distant, membranous.—  
T. H.

GENUS ARACHNIDIUM, *Hincks*. (*ἀράχνιον*, a spider's web.)

*Zoarium* membranaceous. *Zoecia* usually separate, distant, adnate, united by a more or less filiform prolongation of the cell wall, so as to form a delicate network.—T. H.

1. A. HIPPOTHOIDES, *Hincks*.

*Arachnidia hippothoides* (T. H.).

Hab.: Isle of Man, Torbay (T. H.).

In all the species of this genus the *Hippothoan* habit of growth is displayed. The cells are ovate and membranous, and are connected by long slender fibres so as to have the appearance of network. A small papilla marks the situation of the orifice. The branching of the cells is arranged with great regularity.

2. A. CLAVATUM, *Hincks*.

*Arachnidia hippothoides* (A. M. N.).

Hab.: Shetland (*Jeffreys and Norman*).

A deep-water species, with the cells long and club-shaped, and connected by fibres. The mode of reticulation is much less regular than in the preceding species.

3. A. FIBROSUM, *Hincks*.



A rare species, with irregularly shaped zoœcia connected by short fibres. The orifice projects and is tubular, and the margin of the cells is surrounded as by a fringe with numerous bristles or setiform processes.

#### FAMILY IV. VESICULARIIDÆ.

*Zoœcia* contracted below, not closely united to the stem at the base, deciduous, destitute of a membranous area. *Zoarium* repent or erect.—T. H.

##### GENUS I. VESICULARIA, Thompson. (*Vesicula*, a bladder.)

*Zoœcia* ovate, distant, disposed regularly in a single series on one aspect of the stem. *Zoarium* phytoid, rooted by a fibrous base. *Polypide* with a small number of tentacles and a gizzard.—T. H.

##### 1. V. SPINOSA, Linnæus. Plate XXIII. fig. 3.

*Sertularia spinosa* (Linn., *E. and S.*, Jameson, Hogg, Lamk., &c.), *S. sericea* (Pallas), *Laomedea spinosa* (Lamæ., De Bl., Temp.), *Valkeria spinosa* (Flem., Dalyell), *L. épineuse* (De Bl.).

Hab.: Guernsey, Devon; Lytham, Isle of Man (T. H.), Liverpool (D. L.), Cornwall (R. Q. C.), Menai Straits, Jersey, Blackpool (A.S.P.), Cullercoats (Alder), St. Andrews (Reid), Leith (D. L., jun.).

This is a singularly graceful and pretty species. It grows in tapering shoots to the height of several inches. Under the microscope this species is easily recognized by the pointed appearance of the branchlets, which are very numerous and short. The zoœcia are arranged on one side of each branch, and are oval and usually number three to an internode. They decrease

in size upwards. They are perfectly transparent, and allow every part of the polypide to be seen. The latter has eight tentacles. Ellis called this the "Sea-silk" Coralline, and it is a very appropriate name.

GENUS II. *AMATHIA*, *Lamourouz.* (*Amathia*, one of the Nereids.)

*Zoarium* consisting of a creeping tubular stem and erect filiform shoots, dichotomously branched. *Zoæcia* subtubular, in two parallel rows, disposed in distinct groups which are placed on one or both sides of the stem, or wind spirally round it; or forming a continuous series.—T. H.

1. *A. LENDIGERA*, *Linnaeus.* Plate XXIII. fig. 4.

*Sertularia lendigera* (*Linn.*, *Pall.*, *E. and S.*, *Lister*, *Hogg*, &c.), *Serialaria lendigera* (*Lamk.*, *Flem.*, *De Bl.*, *R. Q. C.*, *G. J.*, *D. L.*, *Ald.*, *D'Orb.*), *Valkeria lendigera* (*Dalyell*).

Hab.: Northumberland (*Ald.*), Filey, Isle of Man, Devon (*T. H.*), Menai Straits, Jersey, Blackpool (*A. S. P.*), Hastings (*Miss Jelly*), Cornwall (*C. W. P.*).

This has been called the "Nit Coralline," and "when we look at it with the naked eye we are reminded of what we have seen on the heads of neglected children: but we have only to apply the lens, and our thoughts are immediately turned away from filth to the groves of Arcadia, for what seemed a *nit*, is seen exactly to resemble a little Pan-pipe."—*Landsborough*.

This species spreads in dense masses over other zoophytes and fuci. The zoæcia are arranged in groups, and each group consists of two parallel rows, each of which contains 4—8 cells gradually decreasing in size. It is an easily recognized species, and from its luxuriant

growth and beauty under the lens is a very favourite specimen amongst zoophytologists. The polypide has eight tentacles.

### GENUS III. BOWERBANKIA, *Farre*.

(In honour of Dr. Bowerbank.)

- . *Zoecia* ovate, disjunct, clustered, often subspirally arranged. *Zoarium* repent or erect. *Polypide* with a small number of tentacles (8—10) and a gizzard.—T. H.

#### 1. *B. IMBRICATA*, *Adams*. Plate XXIII. fig. 5.

*Sertularia imbricata* (*Adams, Thompson, Stewart*), *Valkeria glomerata* (*Coldstream*), *Serialaria imbricata* et *verticillata* (*Templeton*), *Valkeria imbricata* (*G. J., R. Q. C.*), *B. densa* (*Farre, G. J., Van Ben.*).

Hab.: Common. Menai Straits, Jersey (*A. S. P.*).

This is an easily recognized species, although its appearance certainly does not suggest that it is an animal. The stem is a long slender thread, irregularly branched, and the *zoecia* occur at intervals in groups. Sometimes, however, it occurs as a repent form. The polypide has ten tentacles, each of which has a single row of setæ along the back.

The colony attains a height of 2—3 inches.

#### 2. *B. CAUDATA*, *Hincks*.

*Valkeria caudata* (*Hincks*).

Hab.: Ilfracombe (*Leipner*).

This resembles the repent form of *B. imbricata*, but the *zoecia* are smaller, and "terminate below in a somewhat spur-like extremity." The polypide has eight tentacles.

#### 3. *B. PUSTULOSA*, *E. and S.*

*Sertularia pustulosa* (*E. and S., Fleming, &c.*), *Vesicularia pustulosa* (*Thompson*), *Valkeria pustulosa* (*G. J., P. H. G., D. L.*).

Hab.: Isle of Wight (*Ellis*), Ilfracombe, Salcombe (*T. H.*), Menai Straits, Jersey (*A. S. P.*), Cornwall (*C. W. P.*).

This is the "Dichotomous Tubular Coralline" of Ellis (*Coral. 54*). The stem is slender, jointed, and branched dichotomously, of a light horn colour. The zoecia are arranged in groups (one group to each internode), and are subspirally arranged on the stem in two series.

The colony attains a height of 2—3 inches. The polypide has eight tentacles.

4. *B. CITRINA*, *Hincks.*

*Valkeria citrina* (*T. H.*).

Hab.: Ilfracombe (*T. H.*).

Distinguished from the preceding by its more slender habit, and by having "a bright line of citron-coloured granules traversing each tentacle, and running down the body, probably marking the course of the œsophagus."

5. *B. GRACILLIMA*, *Hincks.*

*Valkeria gracillima* (*T. H.*).

Hab.: Devon and Cornwall (*T. H.*).

The zoecia are disposed in small groups at intervals along a creeping stem. They are larger than in the two preceding species, and are flask-shaped.

GENUS IV. *AVENELLA*, *Dalyell.* (*Avena*, oats.)

*Zoecia* solitary, irregularly scattered, subunilateral, curved, and slightly contracted above. *Stem* repent, nearly simple. *Polypides* with numerous tentacles, and a small gizzard.—*T. H.*

1. *A. FUSCA*, *Dalyell*.

*A. Dalyellii* (*Thompson*).

Hab.: Scotland (*Dalyell*, *Thompson*).

A deep-water species, with cells "not unlike the ergot of rye." The cells are about  $\frac{1}{16}$  in. long, somewhat flask-shaped, and curved with a number of bristles projecting from the sides. They arise at intervals along a slender stem.

#### GENUS V. *FARRELLA*, *Ehrenberg*.

(In honour of Dr. Farre.)

*Zoæcia* with a bilabiate orifice, elliptical, scattered. *Zoarium* repent. *Polypides* without a gizzard.—T. H.

1. *F. REPENS*, *Farre*.

*Lagenella repens* (*Farre*, *Thompson*), *Bowerbankia repens* (*G. J.*), *Laguncula repens* (*Van Ben.*), *L. elongata* (*Van Ben.*), *Farrella producta* (*T. H.*, *D. L.*).

Hab.: Isle of Sheppey (*Farre*), Lancashire Coast (*T. H.*).

"The cells are oblong, transparent, pedunculate, springing irregularly from the sides and upper surface of a repent stem. Tentacles 12."

This genus differs from the four preceding genera in the fact that the polypides are destitute of a gizzard. Van Beneden has made this genus a special object of study ("Recherches sur l'organisation des *Laguncula*," Mém. Acad. Roy. Bruxelles, xviii., 25).

#### FAMILY V. *BUSKIIDÆ*.

*Zoæcia* contracted below, not continuous with the creeping stolon, with an aperture on the ventral surface.—T. H.

GENUS *BUSKIA*, *Alder*.

(In honour of Prof. Busk.)

*Zoæcia* corneous, flask-shaped, decumbent, adherent for a great part of their length, developed at intervals from a creeping tubular stem; a membranous area on the ventral (or under) side immediately below the orifice. *Polypide* with a small number of tentacles. *Gizzard*?—T. H.

1. *B. NITENS*, *Alder*.

Hab.: Northumberland (*Ald.*), Guernsey, Devon, Yorkshire Coast (*T. H.*), Wick (*C. W. P.*), Plymouth (*A. S. P.*).

"Minute, horn-coloured, shining, creeping fibre branching or anastomosing, with occasional short spinous offsets. Cells ovate or flask-shaped, tapering towards the orifice, the margin of which is thickened and slightly nodulous; sides of the cells produced into irregular flattened spines adhering to the substance on which it creeps, and giving the cells an insect-like appearance. Tentacles 8, short, and rather stout."—*Alder*.

## FAMILY VI. CYLINDRÆCHIDÆ.

*Zoæcia* not contracted below, closely united to the stem at the base, not deciduous; destitute of a membranous area.—T. H.

GENUS *CYLINDRÆCIUM*, *Hincks*. (κύλινδρος, a cylinder; οἶκίον, a home.)

*Zoæcia* elongate, cylindrical, crowded together or scattered, rising from a creeping stolon. *Polypide* without a gizzard.—T. H.

1. *C. GIGANTEUM*, *Busk*.

*Farrella gigantea* (*Busk, Gosse, McA.*), *Avenella gigantea* (*T. H.*).

Hab.: Tenby (*Busk*).

The cells are very long, cylindrical, and incrustated with earthy matter. They are developed upon a creeping stolon, crowded together, or at very short intervals.

2. *C. DILATATUM*, *Hincks*.

*Farrella dilatata* (*T. H.*), *Avenella dilatata* (*T. H.*), *Farrella fusca* (*Busk*), *Avenella fusca* (*Alder, A. M. N.*), *Vesicularia fusca forma simplex* (*Smitt*).

Hab.: Devon, Llandudno, Isle of Man (*T. H.*), Cullercoats on other zoophytes (*Ald.*), Shetland (*A. M. N.*).

The cells are smaller than in the preceding species, and are developed from protuberances on the stolon. "It is of an opaque ochre-yellow colour when fresh, but changes to a blackish-brown on exposure to the air. The tentacles number 20, and have an opaque white line down the centre."—*Alder*.

3. *C. PUSILLUM*, *Hincks*.

Hab.: Salcombe, Ilfracombe (*T. H.*).

A minute species found on tangle roots.

## GENUS II. *ANGUINELLA*, *Van Beneden*. (*Anguina*, a snake.)

*Zoarium* consisting of an erect common stem, giving off branches at intervals, on which the cells are borne; the ectocyst incrustated by earthy matter, opaque. *Zoecia* cylindrical. *Polypides* without a gizzard.—*T. H.*

1. *A. PALMATA*, *Van Beneden*.



Hab.: Tenby (*Bask*), Filey (*T. H.*), Ilfracombe (*A. M. N.*).

"*Zoophyte* dendroid, thickly branched from the base to the summit, more or less palmate, of an earthy brown colour. *Zoecia* cylindrical, irregularly distributed on the branches, with which they are continuous below."—*Hutch.*

This species grows to a height of several inches, and, in the opinion of Mr. Bask, "resembles a small fungus covered with wool."

#### FAMILY VII. TRITICELLIDÆ.

*Zoecia horay*, with an aperture and membranous area on the ventral aspect; borne on a rigid peduncle, to which they are attached by a movable joint, deciduous. —*T. H.*

Genus I. *TRITICELLA*, *Dalzell* (*Triticum*, wheat.)

Stem repent. *Zoecia* with a membranous area on one side (the ventral), flat or slightly depressed; more or less gibbous on the other (the dorsal); compressed laterally, attached by a movable joint to a rigid peduncle. *Polypide* without a gizzard. —*T. H.*

1. *T. FLAVA*, *Dalzell*.

Hab.: Scotland (*Dalzell*).

A doubtful species, not improbably a form of the following one.

2. *T. KORNUL*, *G. O. Sars*.

*T. flava* (*A. M. N.*).

Hab.: Near Oban (*A. M. N.*), on Crustacea.

Grows to a height of about  $\frac{1}{2}$  inch. The cells are transparent, elongately oval, and developed at intervals on a creeping stem. Each cell is borne upon a peduncle

as long as itself. The tentacles are 18, and "nearly equal the cell in height."

3. *T. PEDICELLATA*, *Alder*.

*Farrella pedicellata* (*Ald.*).

Hab.: Northumberland (*Ald.*).

"Body ovate-oblong, yellowish, transparent, with long and very slender pedicels uniform in thickness throughout, arising from a creeping fibre. Tentacles 12. Length of cell  $\frac{1}{30}$  in."—*Alder*.

GENUS II. *HIPPURARIA*, *Busk*. (*ἵππος*, a horse, and *οὐρά*, a tail.)

*Stem* repent or erect, tubular, jointed, nodular. *Zoæcia* with a membranous area on the front or ventral side, attached to a peduncle by a movable joint, and disposed in whorls or groups at the nodes.—*T. H.*

1. *H. EGERTONI*, *Busk*.

Described in the Proceedings of the Zool. Soc. Lond., Jan. 6, 1874, p. 29. The description there is founded on a fragment about  $\frac{1}{4}$  inch in length.

#### FAMILY VIII. VALKERIIDÆ.

*Zoæcia* contracted below, deciduous, destitute of a membranous area.—*T. H.*

In this and the two succeeding families the tentacles do not form a complete circle, two of them being always everted. These families are on this account grouped as *Campylonemida*.

GENUS *VALKERIA*, *Fleming*.

(In honour of Dr. Walker.)

*Zoarium* erect or repent. *Zoæcia* ovate, clustered. *Polypide* destitute of a gizzard.—*T. H.*

1. *VALKERIA UVA*, *Linnaeus*.

NATURAL HISTORY OF

*a uva* (Linn., E. and S., Jameson, &c.), *S. Pallas*), *S. cuscuta* (Linn., Pallas, E. and S., Flem., &c.), *Clytia uva* (Lamx., Temp.), *Cammaria ovifera* (De Bl.), *Valkeria cuscuta* (Flem., Furre, Dalyell, G. J., D. L., Smitt, Joliet), *Nigellastrum cuscutum* (Oken), *Vesicularia cuscuta* (Thompson), *Cuscularia cuscuta* (De Bl.).

Hab.: Widely distributed.

There are two varieties of this species, one repent and the other erect. The former is the "Grape Coralline" of Ellis, the latter is named by him "The Climbing Dodder-like Coralline" (Ellis, Corall., 27, 28). The erect form attains a height of from 2—4 inches. The stem is jointed and branched, and the cells, which are slender and transparent, are borne in clusters at the joints like bunches of grapes. Respecting the repent form (*uva*), Ellis writes:—"Each vesicle has a black spot in it like the spawn of frogs, or rather these look, when they are magnified, like a bunch of full-ripe transparent oval-shaped grapes with the stones in them. To my surprise," he adds, "under my magnifying glasses those grape-like bodies were a cluster of polyps, each having eight claws very lively. What we discover as a spot is only the intestines of the polype with its food in it."

2. *V. TREMULA*, Hincks.

*Campylonema tremulum* (T. H.).

Hab.: Devon (T. H.).

A minute species with tapering cells.

FAMILY IX. MIMOSELLIDÆ.

*Zoecia contracted below, movable, deciduous, with an aperture on the ventral side.*—T. H.

GENUS MIMOSELLA, *Hincks*. (*Mimosa*, the Sensitive Plant.)

*Zoarium* phytoid, regularly jointed, consisting of a creeping tubular base and erect shoots, much and irregularly branched, branches opposite. *Zoæcia* ovate, biserial, opposite, attached to the sides of the stem by a basal joint, by means of which they can be moved to and fro and folded together. *Polypides* with a small number of tentacles; without a gizzard. —T. H.

1. M. GRACILIS, *Hincks*.

*Valkeria cuscuta* (R. Q. C.). Plate XXIII. fig. 6.

Hab.: Torbay (T. H.), Cornwall (R. Q. C.), Guernsey (Cooper).

This beautiful species is found on *Halidrys siliquosa*, upon which it rises to a height of one to four inches. The zoarium is exceedingly graceful, and grows in a plant-like manner. The stem is regularly jointed, and gives off irregular branches which are opposite, and bear the zoæcia. The latter are "ovate, elongate, biserial and opposite, and attached to small prominences on the side of the branch, which is perforated. A circular orifice on one side of the cell near the base fits over this, and a joint is thus secured, by means of which the polyp can move its dwelling forward in one direction, and backward." The cells on a branch are often folded together on the upper side "just as the leaflets close on the leaf of the sensitive plant (*Mimosa*)."  
The cells are rounded at the end of each branch, and become more and more elongated as they near the stem.

NATURAL HISTORY OF

FAMILY X. VICTORELLIDÆ.

originating in an enlargement of the creeping stem, with which they are continuous at the base; free and cylindrical; not deciduous.—

GENUS VICTORELLA, Saville Kent.

consisting of a creeping ramified stem, which is divided out at intervals into somewhat fusiform enlargements, in which the cells originate. The stem is decumbent at the base, which is continuous with the stem, above free and cylindrical; branches arise off from the sides of the expansions in the course of the stem. *Polypides* with few tentacles; no gizzard.—T. H.

1. V. PAVIDA, Saville Kent.

Hab.: Victoria Dock, London (S. K.).

A minute species found on *C. lacustris*, in brackish water. Its characters appear in the generic description.

Described by Mr. W. Saville Kent in the Q. J. M. S. (N.S.), x. (1870), 34.

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SUB-ORDER IV.: PALUDICELLEA.

FAMILY PALUDICELLIDÆ.

*The only Family. Species found in fresh water.*

GENUS PALUDICELLA, Gervais.

*Cænæcium* membrano-corneous, branched, branches composed of a series of claviform cells placed end to end, and separated by complete septa; orifices tubular,

lateral, near wide extremity of each cell. *Lophophore* orbicular. No *epistome* or *calyx*.—*Allman*.

1. P. EHRENBORGII, *Van Beneden*. Plate XXIV. figs. 5, 6.

*Alcyonella articulata* (*Ehrenberg*), *A. diaphana* (*Nordmann, Wrigman*), *P. articulata* (*Gervais, Van Ben., G. J., D. L., Allman*), *P. procumbens* (*Hancock, Ald.*).

Hab.: Widely distributed in canals and lakes.

This is the only fresh-water species known of the *Gymnolæmata*.

“Of all the genera of fresh-water polyzoa this is the easiest to distinguish; but it is the most difficult to discover. The naturalist who is occupied with the study of these lower animals may have it under his eyes for some time without knowing it, as the tubes are so slender, and the colony bears so strong a resemblance to a plant, that he would not dream of examining it.”—*Van Beneden*.

The polypes have 16 tentacles, and are lodged in cells separated by distinct septa. The mode of growth is stiff. The colony is trichotomously branched, and the branches project almost at right angles from the stem. The orifice is on the side of the cell near the top. The cell itself is elongate and claviform.

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## Order II. PHYLACTOLÆMATA. (LOPHOPEA.)

*Lophophore* bilateral; mouth with an *epistome*. Arms of *lophophore* free or obsolete.

### FAMILY I. CRISTATELLIDÆ.

*Cænæcium* free, locomotive.

GENUS CRISTATELLA, Cuvier. (*Crista*, a crest.)

*Cænæcium* sacciform, hyaline, with a common flattened disc, adapted for locomotion; orifices placed on the surface opposite to the disc, and arranged in several concentric marginal series. *Statoblasts* orbicular, with an annulus and marginal spines.—*Allman*.

1. *C. MUCEDO*, Cuvier. Plate XXIV. fig. 1.

*C. vagans* (*Lamk.*, *Lamx.*, *Schweigger*, *Goldfuss*, *De Bl.*), *C. mirabilis* (*Dalyell*), *C. moissisure* (*Gervais*), *Alcyonella secundus evolutionis gradus* (*Raspail*).

Hab.: Lakes and ponds.

This is the only polyzoon which is locomotive. It creeps along by its flattened disc over the stems and leaves of aquatic plants. The entire colony is oval, convex above, and flattened into the locomotive disc below. The orifices through which the polypides emerge are ranged in three concentric rows a little above and around the margin of the upper surface, leaving the central portion of the convexity without openings.

The statoblasts are very pretty objects, and are about  $\frac{1}{35}$  inch in diameter. They are orbicular in shape, reddish-brown in the centre, surrounded by an annulus which is yellowish in colour, and armed with spines projecting beyond the annulus and terminating in curved hooks. (Plate XXIV. fig. 2.)

FAMILY II. PLUMATELLIDÆ.

*Cænæcium* rooted.

GENUS LOPHOPUS, Dumortier. (λόφος, a crest;  
πούς, a foot.)

*Cænæcium* sacciform, hyaline, with a disc which



serves for attachment, but not for locomotion. *Ectocyst* gelatinoid; orifices scattered. *Statoblasts* elliptical, with an annulus, but without marginal spines.—*Allman*.

L. CRYSTALLINUS, *Pallas*.

Polype à Panache (*Trembley*), Bell-flower animal (*Baker*), *Tubularia crystallina* (*Pallas*), *T. campanulata* (*Linn.*, *Turt.*, *Shaw*), *T. reptans* (*Linn.*), *Plumatella cristata* (*Lamk.*, *Schweigger*, *De Bl.*), *Naisa reptans* (*Lamx.*, *Deslongchamps*), *Alcyonella tertius evolutionis gradus* (*Raspail*), *Plumatella crystallina* (*Gervais*), *Alcyonella stagnorum* (*G. J.*, in part), *L. Bakeri* (*Van Ben.*).

Hab.: In ponds.

The polypides of this delicate and beautiful species are brownish-yellow in colour, and are enclosed in a gelatinoid extension of the ectocyst which is quite transparent. The tentacles are long and numerous. The colony generally assumes a lobed appearance. Prof. Allmann observes that the perigastric space often contains spherical bodies floating about, varying in size and structure, being sometimes unicellular in appearance, and at others having a number of enclosed smaller cells. The Professor considers these bodies as having no connection with the polyzoon, and as being without doubt parasitic.

The statoblasts are elliptical, with a plain reddish-brown centre, and a cellular annulus terminating at each end in a point.

GENUS II. *ALCYONELLA*, *Lamarck*.

*Cœnœcium* composed of membrano-corneous branched tubes, which adhere to one another by their sides; orifices terminal. *Statoblasts* elliptical, with an annulus, but without marginal spines.—*Allman*.

1. *A. FUNGOSA*, *Pallas*.

*Tubularia fungosa* (*Pallas*), *Spongia lacustris* (*Schmiedel*), *A. fluviatile* (*Brugière*, *Bosc*, *Lamx.*, *Raspail*, *Gervais*), *A. stagnorum* (*Lamk.*, *Schweigger*, *Lamx.*, *Meyen*, *Ehrenberg*, *De Bl.*, *Carus*, *Dumortier*, *Teale*, *G. J.*, *D. L.*, *J. Alder*, *Siebold*), *A. anceps* (*Dalyell*), *A. gelatinosa* (*Dalyell*).

Hab.: Canals, rivers, &c.

This species grows in large brown fungoid masses attached to submerged branches or twigs, stones, &c. The ectocyst covers the extremities of the tubes of which the colony is composed with a gelatinous covering. The tubes are five or six-sided, and run side by side, presenting a honeycombed appearance. The statoblasts are broadly elliptical, with an areolated disc and a cellular annulus without spines.

2. *A. BENEDENI*, *Allman*.

Hab.: Stagnant waters, River Chelmar, Essex (*Prof. Allman*).

This species is smaller than the preceding, and has the extremities of the tubes of which the colony is composed free from each other. The statoblasts are bean-shaped, with mammilated discs and annuli.

3. *A. FLABELLUM*, *Van Beneden*.

Hab.: Slowly running waters.

This is a small species, and is easily distinguishable. It grows to the length of about  $\frac{1}{2}$  inch, and presents the appearance of two fan-shaped bundles of tubes united at their bases by a single short tube. Each tube has a furrow along its upper surface. The colour is dark brown. The statoblast is described by Van Beneden as "broadly elliptical." The polypides have about 40 tentacles.

GENUS III. PLUMATELLA, *Lamarck*.

*Cænæcium* confervoid, branched, composed of a series of membrano-corneous tubular cells, each of which constitutes a short ramulus with a terminal orifice; branches distinct from one another. *Lophophore* crescentic. *Statoblasts* elliptical, with an annulus, but without marginal spines.—*Allman*.

1. *P. REPENS*, *Linnaeus*. Plate XXIV. fig. 3.

*Tubipora repens* (*Linn.*), *Tubularia repens* (*Müll., Gmelin, Turt.*), *T. lucifuga* (*Vaucher*), *P. lucifuga* (*Lamk., De Bl.*), *Naisa repens* (*Lamx.*), *Alcyonella stagnorum* (*Ehrenberg*), *P. campanulata* (*Van Ben., Blumenbach, Gmelin, Lamk., Schweigger, De Bl., Risso, Gervais*), *Federbusch Polyp* (*Rosel*), *Tubularia gelatinosa* (*Pall.*), *T. reptans* (*Turt.*), *Naisa campanulata* (*Lamx., Deslongchamps*), *Lophopus campanulatus* (*Dumortier*).

Hab.: In dark places under leaves, &c., in lakes and ponds.

There are two varieties of this species, one which creeps along the surfaces of stones and weeds, and the other which is free. A combination of these modes of growth is often found. As its synonym *lucifuga* implies, this species avoids the light, and must be looked for on the under surface of stones, &c. It spreads in a distinctly dendritic manner, and is irregularly branched. The orifices of the cells are long and tubular. The polypide has about 60 tentacles, and the calyx surrounding the base of the tentacles is a prominent object. The statoblasts are broadly elliptical, with a reddish-brown centre and a dark brown cellular annulus.

2. *P. PUNCTATA*, *Hancock*.

NATURAL HISTORY OF

Northumberland (*Hancock*).

A small species with a transparent greenish membrane of about half an inch in length. The branches are "composed of a series of large conical cells tapering towards the upper portion of the cell, almost colourless, and freckled with minute opaque white spots." The tentacles number 60, and are white, with a distinct festooned calyx.

The statoblasts are described as perfectly black, broad, and oval.

3. *P. FRUTICOSA*, *Allman*.

Hab.: In lakes and ponds.

This species resembles the free variety of *P. repens* or *F. sultana* in general appearance. It is bushy, and irregularly branched. The cells and branches are cylindrical, and the statoblasts are elongately oval, with a broad cellular annulus.

4. *P. CORALLOIDES*, *Allman*.

Hab.: London Docks (*G. J. A.*).

A transition species between *A. fungosa* and the present genus. It forms dense tufts of  $\frac{1}{2}$  inch to an inch in height, dichotomously branched. The colour is yellowish-brown. The number of tentacles is about 60. The statoblasts are broad.

5. *P. EMARGINATA*, *Allman*.

Hab.: Streams and rivulets.

In this species there is a prominent furrow down one side of each cell, commencing with a triangular space near the orifice. The zoophyte is found on the under side of stones. It covers the ectocyst with minute particles of sand, which give it a granular appearance. The tentacles are 40 in number. The statoblasts are elongately oval.

6. *P. ALLMANI*, *Hancock*.

Hab.: Bromley Lough, Northumberland.

Described by Mr. Hancock in the *Ann. of Nat. Hist.* (2nd series) vol. v., 200. The cells are distinctly claviform, and the zoophyte is adherent to the under-side of stones. The tentacles number 42, and have a festooned calyx. The statoblasts are black and elongately oval, with pellucid margins.

7. *P. ELEGANS*, *Allman*.

Hab.: Bandon, Cork.

"Cœnocium adherent, creeping, cells of uniform diameter, with a furrow and keel. Calyx but slightly festooned. Statoblasts broad."—*Allman*.

8. *P. DUMORTIERI*, *Allman*.

Hab.: In a pond at Crix, Essex.

9. *P. JUGALIS*, *Allman*.

Hab.: Canal near Little Baddow, Essex.

These two species are small and adherent. The former has the cœnocium irregularly branched; in the latter it consists of "two series of branches connected by a common tube and extending in opposite directions."

GENUS IV. *FREDERICELLA*, *Gervais*.

*Cœnocium* confervoid, composed of a membrano-corneous branched tube, with the branches distinct from one another, and terminated by the orifices. *Lophophore* nearly circular, tentacular crown campanulate. *Statoblasts* bean-shaped, destitute of annulus and spines.—*Allman*.

1. *F. SULTANA*, *Blumenbach*.

*Tubularia sultana* (*Blumenbach*, *Gmelin*, *Turt.*), *Naisa sultana* (*Lamx.*), *Plumatella gelatinosa* (*Flem.*), *Diffugia*

NATURAL HISTORY OF

otœiformis (*Meyen*), Plumatella sultana (*Dumortier*, *G. J.*, *D. L.*, *Alder*), *F. dilatata* (*Allman*).

Hab. : Generally distributed on submerged stones and stems.

The characteristics of the species are set forth in the generic description. It grows freely, and is often much branched. The orifices are at the end of the branches, and are usually in couples. The tentacles number about 24, and form a campanulate corona which presents a beautiful appearance.

The statoblasts have no annulus.

**Holobranchia. GROUP b. Entoprocta.**

*Polyzoa having both orifices of the alimentary canal within the lophophore; tentacular sheath wanting; tentacles bilaterally disposed, not retractile. No perivisceral cavity.*—T. H.

**Order PEDICELLINEA.**

**FAMILY I. PEDICELLINIDÆ.**

*Polypides borne on a retractile peduncle, united in colonies by a creeping stolon.*—T. H.

GENUS PEDICELLINA, *Sars*. (*Pes*, a foot.)

*Polypides* pedunculate, arranged along a creeping ramified stolon; the body separated by a diaphragm from the stem, and deciduous; tentacular crown terminal.—T. H.

1. *P. CERNUA*, *Pallas*. Plate XXIII. fig. 7.

*Brachionus cernuus* (*Pall.*), *Hydra coronata* (*Flem.*), *P. echinata* (*Sars*, *Hassall*, *P. H. G.*, *G. J.*, *D. L.*, *Reid*, *Smitt*, &c.), *P. Belgica* (*P. H. G.*, *T. H.*). Fleshy polyps of a red colour (*Ellis*).

Hab. : Common.

This species has been described by Prof. Allman as

phyllactolæmatous, but Mr. Hincks does not so class it. The polypide is of a whitish colour, transparent, somewhat cup-shaped, and borne on a long flexible stem which is usually covered with short spines.

The tentacles vary in number up to 24. The body of the polypide is separated from the stem by a diaphragm. It frequently falls off, and is renewed by gemmation.

2. *P. NUTANS*, *Dalyell*.

Hab.: Scotland (*Dalyell*), Tenby (*Leipner*).

This species is smaller than the preceding, and is always destitute of spines. The stem tapers just below its junction with the polypide. The stolon is distinctly jointed.

3. *P. GRACILIS*, *Sars*.

Hab.: Widely distributed.

The polypide and stem are much smaller than on *P. cernua*, from which also this species may be distinguished by the peduncle, which is "expanded below into a short, thick cylinder, above which it is extremely slender, widening upwards to the point of junction with the polypide."

## FAMILY II. LOXOSOMIDÆ.

*Polypides* borne on a contractile peduncle, solitary, always furnished in the young state with a pedal gland; gemmæ produced on the body of the polypide.—T. H.

GENUS *LOXOSOMA*, *Keferstein*. (λοξός, oblique;  
σῶμα, a body.)

*Polypides* pedunculate, solitary, the body closely united to the stem, and not deciduous; tentacular crown placed obliquely on the ventral side of the body.—T. H.



NATURAL HISTORY OF

CLARE, *Keferstein*.

: On annelids, Shetland (*McI.*).

species of this genus are solitary, and are shed when young by a pedal gland which serves stolon.

4. *L. PHASCOLOSOMATUM*, *Carl Vogt*.

p.: On annelids, Bantry Bay (*A. M. N.*).

Described by Rev. A. M. Norman in *Ann. of Nat. Hist.* for February, 1879, p. 133.

3. *L. CLAVIFORME*, *Hincks*.

Named from specimens in spirit obtained by Dr. McIntosh at Guernsey.

---

SUB-CLASS **Pterobranchia**, *Ray Lankester*.

*Lophophore produced on each side into a process on which alone the tentacles are developed, forming discontinuous series.*

Order **PODOSTOMATA**, *Ray Lankester*.

*Foot large, overhanging the mouth.*

FAMILY **RHABDOPLEURIDÆ**.

*Zoarium a chitinous, adherent tube, divided by septa into compartments, from which erect tubular cells rise, in which the polypides are lodged; the whole of the adherent portions traversed by a chitinous cylindrical rod, to which the polypides are attached by means of a flexible cord; endocyst not differentiated, and the polypide consequently unattached to its cell; retractor and other muscles absent; a large shield-like organ (foot) placed near the mouth; the young (bud) furnished with two valve-like fleshy plates.—T. H.*

GENUS RHABDOPLEURA, *Allman*. (ῥάβδος, rod;  
πλευρά, side.)

Generic character identical with that of the family.

1. *R. NORMANI*, *Allman*.

Hab.: Shetland (*A. M. N.*).

For a description of this species, and of the curious structure of the members of this family, the reader is referred to the *Q. J. M. S.*, January, 1869, where is an article by Prof. Allman, who has made this species a special object of study. For the purposes of this book it is sufficient to state that *Rhabdopleura* is remarkable from the shape of the lophophore, and the disposition of the tentacles. The former is prolonged into two projecting arms or plumes, upon each of which is borne a double row of tentacles. There are other peculiarities of structure which are dealt with in the article referred to.

2. *R. COMPACTA*.

Found on the coast of Antrim in deep water by Mr. Hyndman.

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Although its exact position is not yet fully made out, it is proper to mention the fresh-water Medusa, *Limnocodium Sowerbii*, found in the Victoria Regia tank in the Royal Botanic Gardens, Regent's Park, in June, 1880, by Mr. Sowerby. The Medusa was described by Prof. Allman ("Nature," xxi. 178) under the name *L. Victoria*, and by Prof. E. Lankester (*Q. J. M. S.*, xx. 351) under the name *Craspedocustes Sowerbii*. Mr. G. J. Romanes ("Nature," xxii. 191) has also studied and described its structure; and recently Mr. A. G. Bourne (*Proc. Roy. Soc.* xxxviii. 9) has described what he believes to be its hydroid phase.

## ZOOPHYTE COLLECTING AND PRESERVING.

In a previous chapter I have pointed out the zones or areas in which the principal species of zoophytes are to be found, and the method of collecting very much depends upon the species desired. For the littoral species, the best course is to select a day when the tide will be far out, and to follow it in its ebb, searching all the rock-pools and crevices, and turning over the sea-weeds carefully to see if any of the desired treasures are concealed there. Much may be done on the spot in the way of collecting, but it is always desirable to take away small quantities of the weeds and shells which come in the way, and reserve them for microscopical investigation at home, as many of the minute species easily escape observation made merely on the coast itself. A good way to discover many of the delicate species is that recommended by the Rev. Thos. Hincks, namely, to lie down at full length beside the rock-pools, and look for the *shadows* cast upon the sides. By this means very delicate species may be sometimes easily detected. Many of the species may be found attached to the long floating leaves of *Laminaria*, and the roots of that weed are sometimes perfect museums of both hydroids and polyzoa. It is remarkable how different species appear to be localized even in a very narrow area. For instance, in such a narrow space as the Menai Straits, I have found *A. pluma* in abundance in one part, and nowhere else, and other species appeared to be localized in a similar manner. For the Medusæ, a hand-net is the readiest means of capture. The Sertularians and larger species must be dredged for to be taken alive, but the polypidoms may

often be found in good condition thrown up by the returning tide. No locality must be considered unsuitable, be it the stem of a weed or the carapace of a crustacean, for the *Lepraliæ* and many other polyzoa are ubiquitous.

Many of the anemones may be kept alive for months in aquaria, and with a little trouble may be maintained in health. They are very beautiful ornaments, to say nothing of their value to the student. When a collection has been obtained, it should be carefully preserved. The best and most effective method of preservation for all the plant-like forms is undoubtedly in spirits of wine. In this medium the branches and pinnæ unfold, and the zoophytes look as if in their native element. From this medium also portions may readily be taken for mounting as microscopic objects; they should, however, be passed through oil of cloves before going into the balsam. It is not convenient always to keep a large collection in spirits, and where this is the case, such of the specimens as are not absolutely required to be preserved in fluid should be well cleaned, and mounted upon black or white cardboard with the name and locality clearly marked beside them. Such of the polyzoa as are found incrusting shells, stones, &c., should be placed in separate boxes, if possible with glass tops, and in all cases carefully named, as, from the absence of spines or markings, or the usage to which a specimen has been subjected, a great deal of time is often required to be expended for its identification; and in order that this time and trouble should not be wasted, each specimen should be immediately labelled or placed in a labelled box when once its name has been ascer-

tained. An attractive way of arranging a collection of *Lepraliæ*, and other similar species, the structure of which is entirely invisible without microscopic observation, is to mount the shell which bears the incrustations on a piece of cardboard, and to annex below it on the same piece a drawing of the cells enlarged to a known scale; the card bearing the zoophyte and drawing should then be placed in a glass-topped box. This enables friends or others interested to appreciate a collection better than the exhibition of a lot of apparently similarly incrustated shells or stones. A specimen of every species obtained should be mounted as a microscopic slide. Those which will show well as transparent objects should be cleaned in spirits of wine, afterwards passed through oil of cloves, then into benzole, and lastly mounted in balsam let down with benzole. Some of the hydroids show their structure most satisfactorily when stained; picrocarmine and hæmatoxylin are the best media to use for this purpose. If the specimen is obtained alive, and it is desired to mount it with the polyps exerted and their tentacles expanded, the best method for killing them so as to show these features is to select a portion of the zoophyte, the polyps of which are healthy and active, and place it in a watch-glass or glass beaker, according to size. After letting the specimen alone for a short time, seize an opportunity when the polyps are extended, and with a pipette or dipping-tube drawn to a fine point, let a drop or two of absolute alcohol run into the water down the glass so as not to fall directly on the polyps. The repetition of this once or twice seems to stupify the zoophyte, and after the lapse of an hour, if the polyps be still extended, alcohol may be added slowly

up to 60 per cent.\* The strength of spirit may be ultimately increased to 90 per cent. Another excellent method is to use Kleinenberg's fluid prepared as follows:—

Water, 100 volumes. Sulphuric acid (concentrated), 2 vols. Picric acid (as much as will dissolve). Filter and dilute with three times its bulk of water.

This fluid should be used in the same way as alcohol, and the objects left in for three or four hours, and afterwards passed to 70 per cent, and ultimately 90 per cent. alcohol. This method is largely used at the Naples Zoological station.†

A one per cent. solution of osmic acid is sometimes recommended as a medium for rapidly killing zoophytes, but it has the quality not only of killing them, but of blackening them at the same time. The black stain, however, may be removed by bleaching in a weak aqueous solution of ferrocyanide of potassium, the specimen being afterwards thoroughly washed.

The majority of zoophytes cannot be mounted as transparent objects, and must be mounted so as to be viewed by reflected light. To accomplish this, the specimen should be well cleansed, care being of course taken not to damage the spines or protuberances, if any, and mounted in a cell having a neat black background, or for some species, as *S. fusca*, a white background. The cell should be made in such a way that

\* See A. D. Michael, Journ. Queckett Club, i. (1883), p. 241, and H. C. Chadwick, "Microscopical News," vol. i. (1883), and "Science Monthly," January, 1884, 92. I have seen a number of beautifully mounted slides by the latter writer.

† See article by Mr. C. O. Whitman in the Postal Micr. Soc. Journal, vol. ii. 99.

the glass cover may be removed, as it is impossible to see the details of many objects through the cover. A good way to accomplish this is to get a small pill-box (glass capped if possible) and fix it to the slide, cutting off from the bottom so much as may be above the required depth, and leaving the lid removable to serve for the cover. The cell so formed may, up to the lid, be finished with white zinc cement, and ringed like an ordinary cell. By this means a not unattractive mount is obtained, which has the additional advantage of a movable cover glass, so as to admit of the close examination of the object with high powers. Where possible, both transparent and opaque mounts should be prepared. All slides should be kept in a flat position in a cabinet, and it is very useful to have labels of different colours for the different classes, e.g. white for *hydroida*, pink for *polyzoa*, and so on, with different shades to distinguish British and foreign species.



## EXPLANATION OF INITIALS, &amp;c.

|           |     |                              |
|-----------|-----|------------------------------|
| E. and S. | . . | Ellis and Solander.          |
| G. J.     | . . | Dr. George Johnston.         |
| D. L.     | . . | Rev. David Landsborough.     |
| R. Q. C.  | . . | R. Q. Couch.                 |
| Ald.      | . . | John Alder.                  |
| T. H.     | . . | Rev. Thomas Hincks.          |
| P. H. G.  | . . | <del>Rev.</del> P. H. Gosse. |
| G. J. A.  | . . | Prof. Allman.                |
| A. M. N.  | . . | Rev. A. M. Norman.           |
| Temp.     | . . | Templeton.                   |
| Flem.     | . . | Fleming.                     |
| Lamk.     | . . | Lamarck.                     |
| Lamx.     | . . | Lamouroux.                   |
| Linn.     | . . | Linnæus.                     |
| Fabr.     | . . | Otho Fabricius.              |
| C. W. P.  | . . | C. W. Peach.                 |
| A. S. P.  | . . | A. S. Pennington.            |
| D'Orb.    | . . | D'Orbigny.                   |
| McI.      | . . | W. C. McIntosh.              |
| McA.      | . . | R. McAndrews.                |
| De Bl.    | . . | De Blainville.               |
| Van Ben.  | . . | Van Beneden.                 |
| Dal.      | . . | Sir Geo. Dalzell.            |
| Pall.     | . . | Pallas.                      |
| M.-Edw.   | . . | Milne-Edwards.               |
| Müll.     | . . | Müller.                      |
| Turt.     | . . | Turton.                      |

*Appendix A.*

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*Appendix B.*

GLOSSARY AND GENERAL INDEX.

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>abnormal</i>, not in the usual manner or shape.<br/> <i>acantium</i>, 141.<br/> <i>adnate</i>, side by side, growing together.<br/> <i>algæ</i>, sea-weeds.<br/> <i>alimentary</i>, relating to food or digestion.<br/> <i>anal</i>, belonging to the excretory orifice.<br/> <i>anastomosing</i>, running into each other.<br/> <i>annulated</i>, ringed.<br/> <i>annulus</i>, a ring.<br/> <i>antenna</i>, the "feeler" of an insect.</p> | <p><i>aperture</i>, an opening or orifice.<br/> <i>apex</i>, the top of anything.<br/> <i>appressed</i>, lying close together.<br/> <i>arborescent</i>, tree-like.<br/> <i>areolate</i>, marked with areolæ or blotches.<br/> <i>articulated</i>, jointed.<br/> <i>auricle</i>, an ear.<br/> <i>avicularia</i>, 208.<br/> <i>axil</i> (adj. <i>axillary</i>), the angle formed at the point of branching.<br/> <i>axis</i>, the main stem or central portion.<br/> <i>bathymetrical</i>, 20.</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# NATURAL HISTORY OF

g to the base.  
two points.  
two segments.  
g two lips.  
o sides.  
rows.

or prominence.  
yzoa.

aining lime.  
atheca.

*campanulate*, bell-shaped.  
*capillary*, hair-like.  
*capitate*, knobbed.  
*capitulum*, the thickened end of  
a tentacle; the anterior region  
of the body in *Edwardsia*.  
*capsule* = gonotheca.  
*cardia*, 204.  
*carinated*, having a keel-like  
prominence.  
*caudate*, having a tail-like ap-  
pendage.  
*celliferous*, cell-bearing.  
*cellular*, composed of cells.  
*cercariae*, 241.  
*chitinous*, composed of chitine.  
*ciliated*, fringed with *cilia*, or  
hair-like filaments.  
*cinclis* (pl. *cinclides*), 142.  
*clavate*, club-shaped.  
*cnidae*, stinging cells.  
*cœnosarc*, 28.  
*columella*, 143.  
*conchula*, 174.  
*contorted*, twisted.  
*corallum*, 143.  
*corbula*, 128.  
*cordate*, heart-shaped.  
*coriaceous*, roughened, leathery.  
*corneous*, horny.  
*corona*, the crown of tentacles  
(Polyzoa).  
*corrugated*, roughened.  
*craspedum*, 141.  
*crenated*, toothed.

*cuneate*, wedge-shaped.  
*cylindrical*, round and elongated.  
*cyst*, a bag or vesicle.

*decumbent*, lying down.  
*dendritic*, *dendroid*, tree-like.  
*denticulate*, toothed; *denticle*,  
a tooth.  
*diaphanous*, transparent.  
*dichotomous*, branching in pairs.  
*distal*, nearest to the oral ex-  
tremity.  
*discoid*, disc-shaped.  
*digitate*, finger-shaped.  
*dorsal*, the back.

*ecthoreum*, 142.  
*ectocyst*, 203.  
*ectoderm*, 23.  
*Ectoprocta*, 210.  
*elliptical*, oval.  
*endocyst*, 203.  
*endoderm*, 23.  
*Entoprocta*, 210.  
*endosarc*, 207.  
*epidermis*, the external covering.  
*epistome*, 202.  
*epithelium*, the external layer of  
the ectoderm.  
*everted*, turned outwards.

*falcate*, sickle-shaped.  
*fasciculus*, a bundle.  
*fauna*, the animals of a region.  
*filiform*, thread-like.  
*frimbriated*, fringed.  
*fissure*, a cleft.  
*flabellate*, *flabelliform*, fan-shaped  
*flexuous*, bending.  
*foliaceous*, leaf-like.  
*friable*, easily broken up.  
*fuci*, sea-weeds.  
*funiculus*, 207.

*ganglion* (pl. *ganglia*), a nerve  
centre.  
*Gasteropod*, a class of Mollusca.  
*gelatinous*, jelly-like.

*geniculated*, knee-jointed.  
*gemma*, a bud; *gemma*tion, bud-  
 ding.  
*gizzard*, 205.  
*globose*, rounded.  
*gonidia*, 140.  
*gonophore*, 29.  
*gonosome*, the reproductive zooids  
 of a hydroid colony.  
*gonotheca*, 11.  
*gonozoid*, 12.  
*granulated*, roughened with  
 granular markings.  
*guard polyps*, 33.  
*gular*, relating to the throat or  
 œsophagus.

*habitat*, know locality of any  
 species.  
*hæmal*, 206.  
*hastate*, spear-shaped.  
*hispid*, roughened.  
*hyaline*, transparent.  
*hydranth* = Polypite.  
*hydrocaulus*, the stem (Hydroids).  
*hydrorhiza* = stolon, or root-like  
 attachment.  
*hydrotheca*, 29.  
*hypostome*, 25.

*imbricated*, overlapping.  
*internode*, the interval between  
 the nodes or joints.  
*iridescent*, having colours like a  
 rainbow.

*labial*, relating to the lips.  
*lamina*, *lamella*, a layer.  
*ligulate*, strap-shaped.  
*lobate*, having lobes or finger-like  
 projections.  
*lophophore*, 19, 202.  
*lunate*, moon-shaped.

*macho-polyp*, 33.  
*mamillated*, having little globes  
 like nipples.

*mandible*, the beak of an avicu-  
 larium.  
*manubrium*, 30.  
*medusa*, 30.  
*mesenteric filaments*, 141.  
*mesial* or *medial*, placed in the  
 middle.  
*mesoderm*, 24, 139.  
*mucro*, a pointed projection.  
*muricated*, roughened with points.  
*natatory*, free swimming.  
*Navicula*, a genus of Diatoms.  
*nematocysts*, thread cells.  
*nematophores*, 121.  
*neural*, 206.

*obsolete*, not developed.  
*ocelli*, 30.  
*œsophagus*, the passage to the  
 stomach or body cavity.  
*œcium* = *ovicel*, 209.  
*opaque*, not transparent.  
*operculum*, a protective covering  
 or lid.  
*oral*, relating to the mouth.  
*orbicular*, circular.  
*orifice* = opening.  
*ova*, eggs; *ovary*, part where  
 eggs are formed.  
*oval*, having the length double the  
 breadth.  
*ovate*, egg-shaped.  
*ovicelligerous*, bearing ovicels.

*pali*, *palules*, 143.  
*palmate*, hand-shaped.  
*palpocil*, a collection of stinging  
 cells.  
*parasitic*, growing upon an or-  
 ganism.  
*parietes* (adj. *parietal*), the body  
 wall.  
*pedal*, relating to the foot or base.  
*pedicel*, *peduncle*, a footstalk.  
*pellucid*, clear, transparent.  
*perforate*, having small openings.  
*perigonium*, 30.



- perisarc*, 28.  
*peristome*, 273.  
*perigastric cavity*, 207.  
*pharynx*, 204.  
*phylogenetic*, accompanying growth.  
*physa*, 177.  
*pinna*, a short branch.  
*pinnate*, bearing pinnæ.  
*planula*, a free-swimming larva.  
*plumose*, feathery.  
*polypide*, the alimentary zooids of the Hydroids.  
*polypites*, the alimentary zooids of the Polyzoa.  
*polyp*, the alimentary zooids of the Zoophytes in general.  
*polypary*, 28.  
*poses*, small openings.  
*prophyllactic*, serving sanitary purposes.  
*proximal*, the end farthest from the mouth.  
*pyloris*, 205.  
*pyriform*, pear-shaped.  
*puncture* (adj. *punctate*), a small opening or depression.  
  
*quincunx*, arranged as at the corners of a square, with one in the centre.  
  
*rachis*, 192.  
*radiated*, having radial lines.  
*ramose*, branched.  
*reniform*, kidney-shaped.  
*reticulate*, net-like.  
*rhomboidal*, four-sided, with two acute and two obtuse angles.  
*rostrum*, a projection in front of the orifice.  
*rugose*, roughened.  
  
*sarcotheca*, 33.  
*scapus*, 177.  
*septum*, a dividing membrane.  
  
*serrate*, toothed.  
*sessile*, without footstalks or joints.  
*seta*, a bristle.  
*setaceous*, bristling.  
*sinuate*, waved.  
*sinus*, a notch.  
*somatic*, 17.  
*spathulate*, spoon-shaped.  
*spherules*, 165.  
*sporosacs*, sac-shaped gonophores.  
*statoblasts*, 209.  
*stellate*, star-shaped.  
*stolon*, a creeping root.  
*striated*, marked with fine lines.  
*sub-* (in composition) = approaching to.  
  
*tactile*, serving for purposes of touch.  
*tentacle*, organs of touch or respiration, or both.  
*transverse*, horizontal.  
*trophosome*, a hydroid colony.  
*truncated*, like a cone, with the apex flattened.  
*tubercle*, a knob or protuberance.  
*tubular*, hollow.  
  
*umbo*, a boss or knob.  
*umbrella*, the swimming-bell of a medusa, 30.  
*unilateral*, one-sided.  
*uniserial*, in a single row.  
*urceolate*, pitcher-shaped.  
  
*velum*, 30.  
*ventricose*, swollen in the middle.  
*verrucose*, covered with tubercles.  
*verticillate*, whorled.  
*vesicle*, a little bladder.  
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*zoarium*, a colony of Polyzoa.  
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*zooid*, an alimentary or reproductive Polyp.

*Appendix C.*

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„ silk, 313.

„ oak, 112.

„ hair, 113.

„ fir, 115.

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PLATE I.

*Diagrams illustrating structure of Hydroida.*

1. Diagram of *Hydra*.
2. Diagram of Hydroid colony.
- 3, 4, 5. Thread-cells.
6. Medusa of Hydroid (after Hincks).
7. Diagram of planula.

For explanations of these diagrams, see chapter on structure of the Hydroida, pp. 22—34.







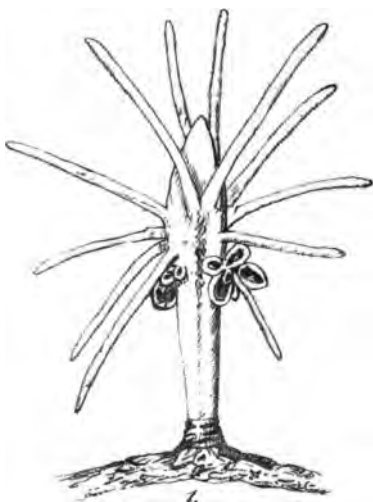




PLATE II.

1. *Clava multicornis*, enlarged (after Hincks), p. 36.
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4. *Cordylophora lacustris*, hydranth enlarged. 4A,  
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5. *Podocoryne carnea*, enlarged, p. 42.

PLATE II.



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PLATE III.

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3. *Stauridium productum*, enlarged (after Allman),  
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4. *Myriothela Cocksii*, nat. size (after Hincks), p. 58.
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6. *Garveia nutans*, nat. size (after Allman), p. 67.
7. *Tubularia larynx*, nat. size, p. 73.
8. *Tubularia Britannica*, nat. size, p. 75.

PLATE III.



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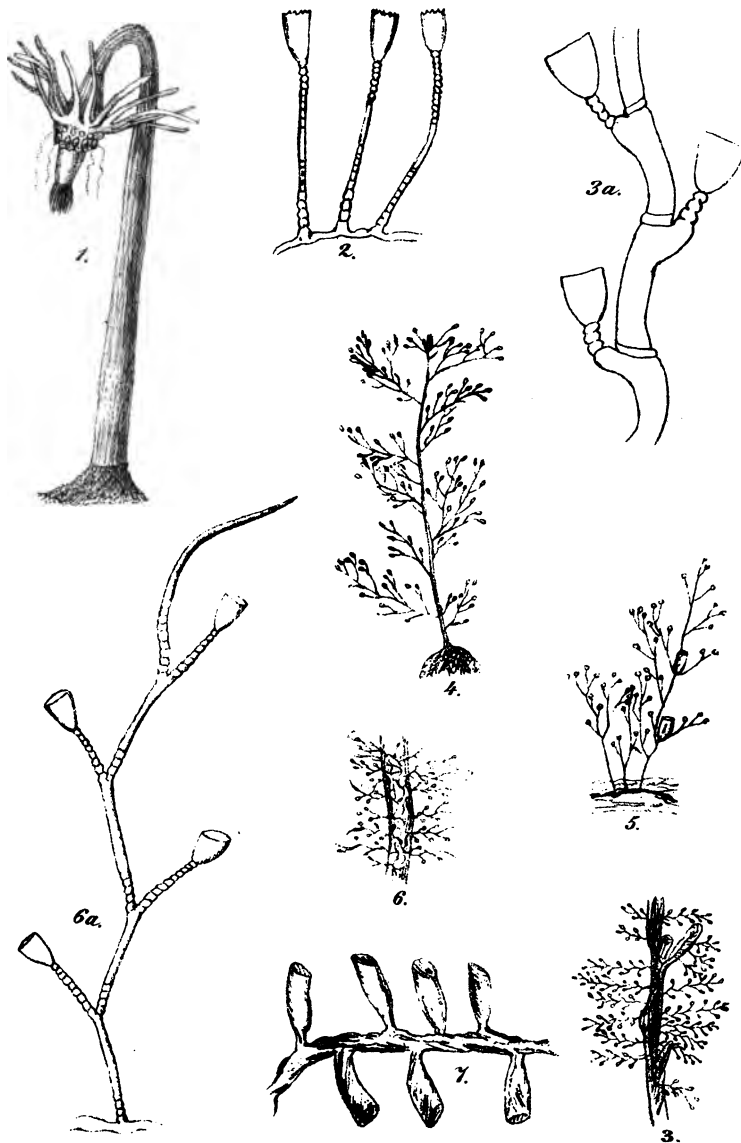




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5. *Campanularia flexuosa*, nat. size, p. 87.
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7. *Lafoëa dumosa*, enlarged, p. 96.

PLATE IV.



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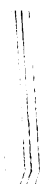


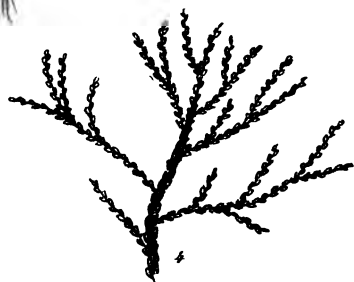
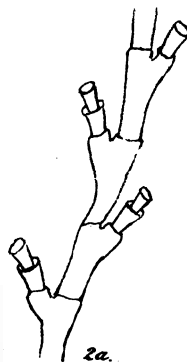
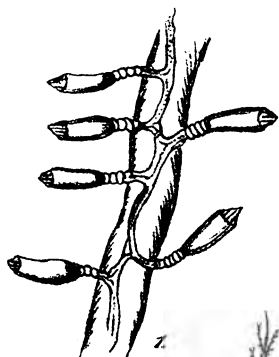




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PLATE V.



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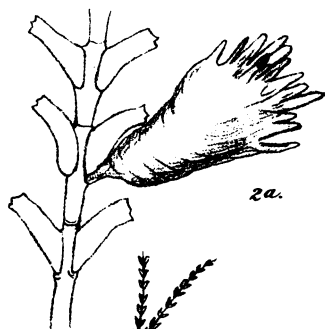


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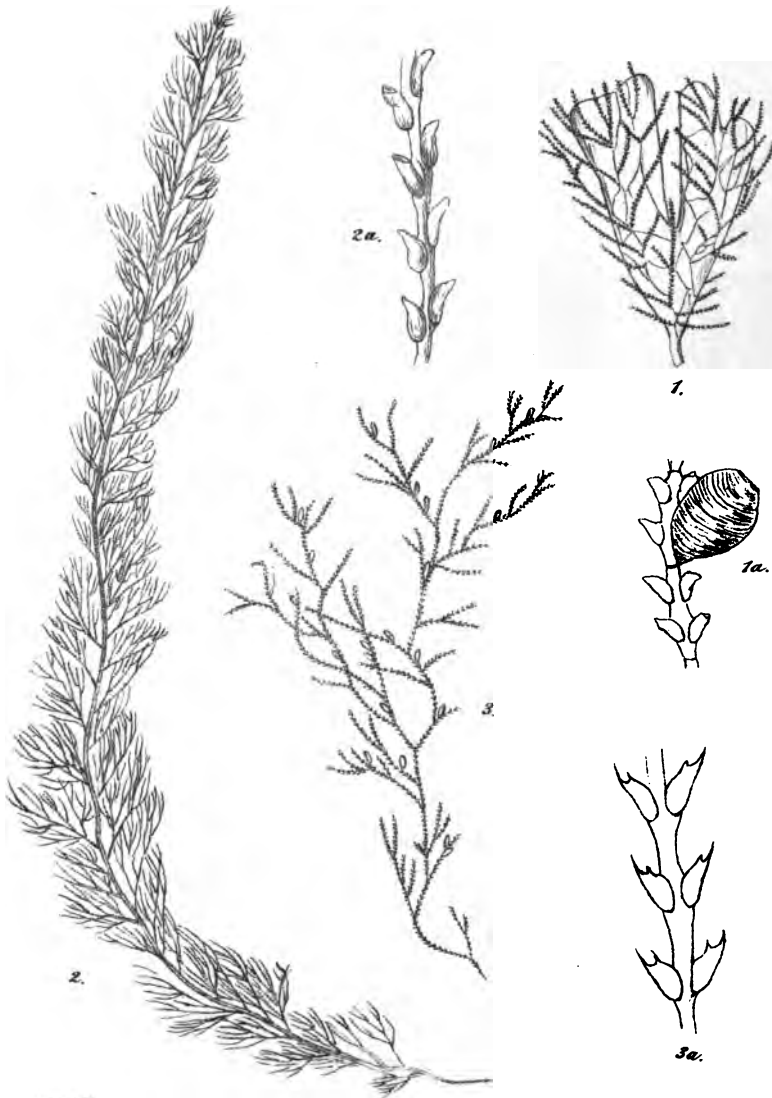




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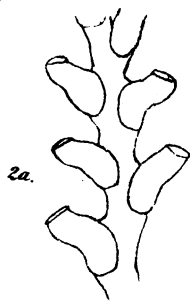
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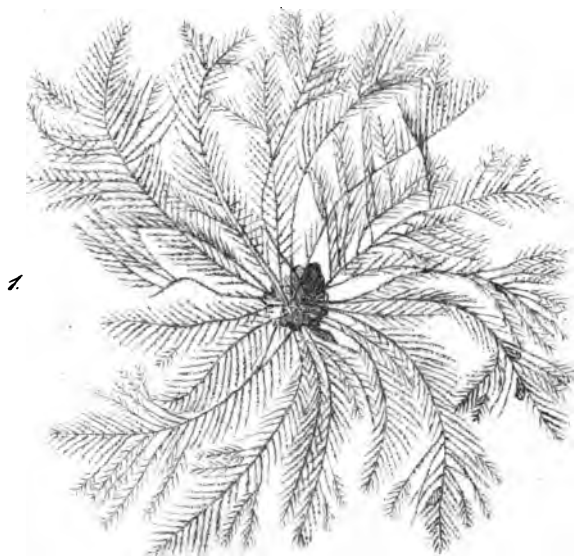
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For descriptions of these figures, see chapter on Anemone Structure, pp. 136—145.

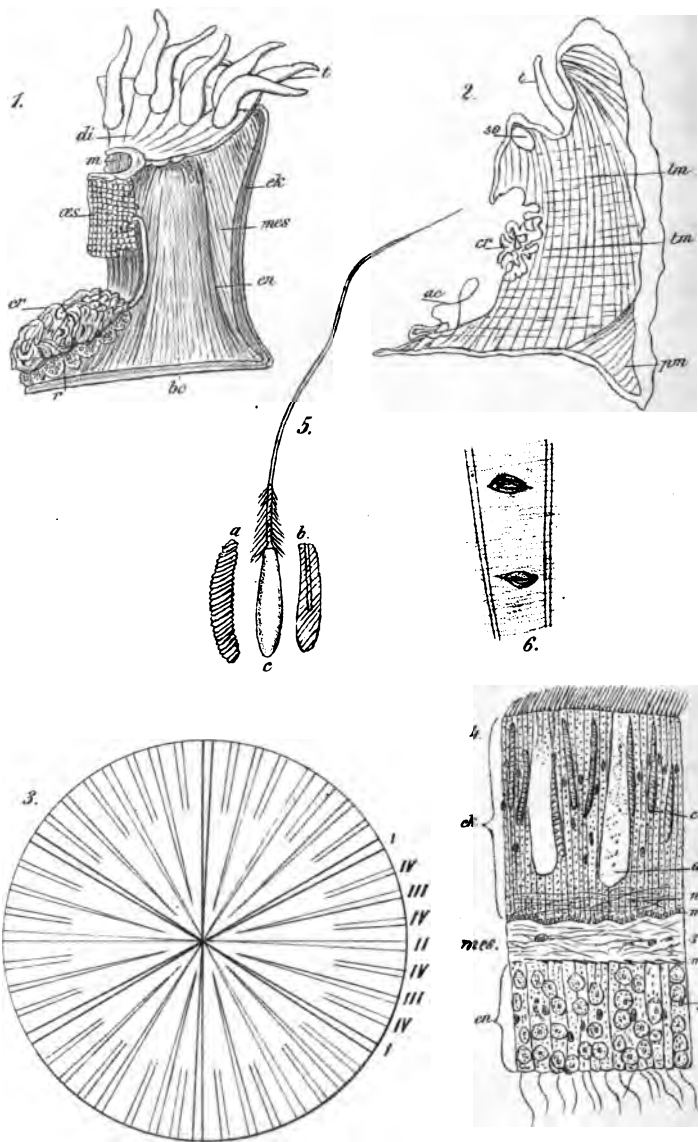


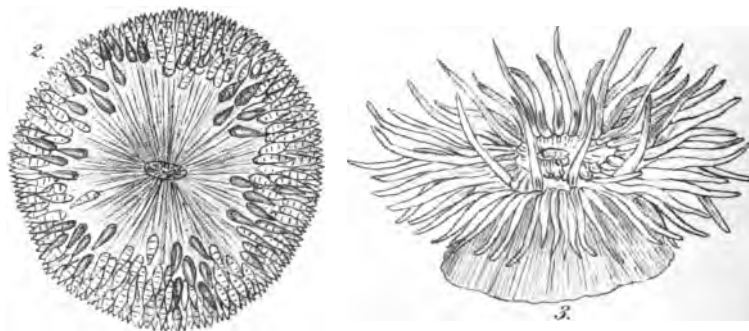




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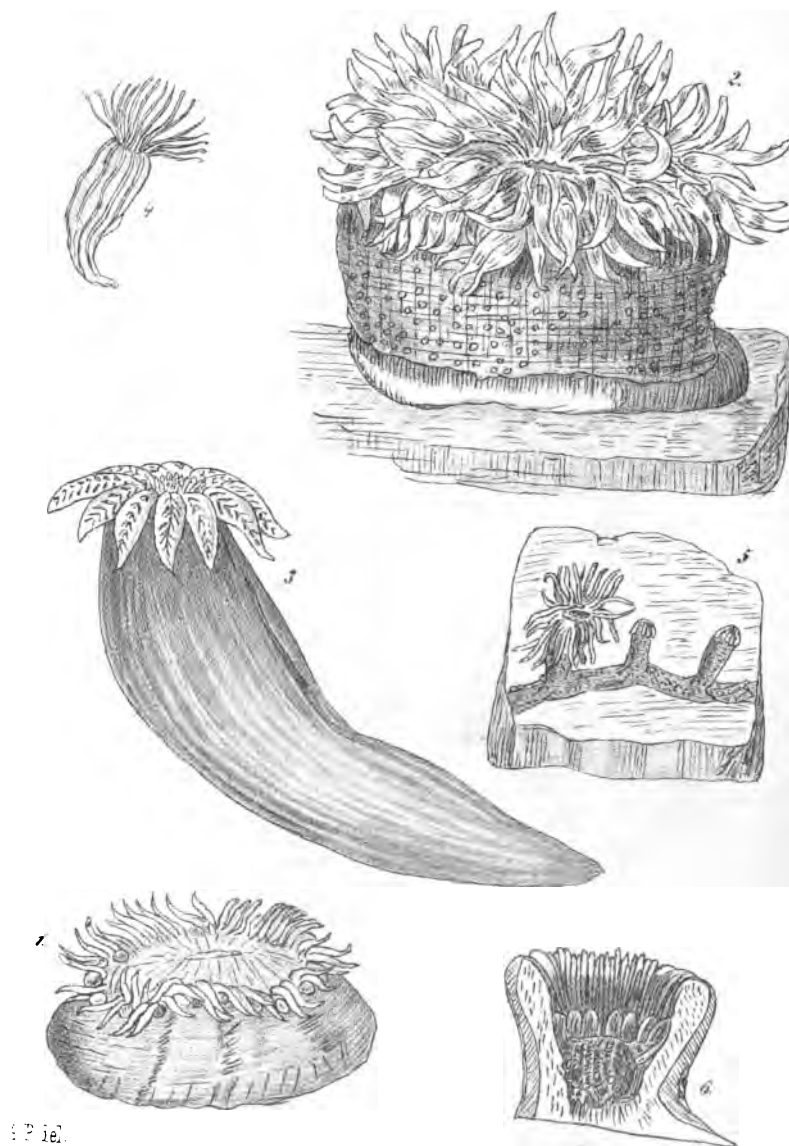
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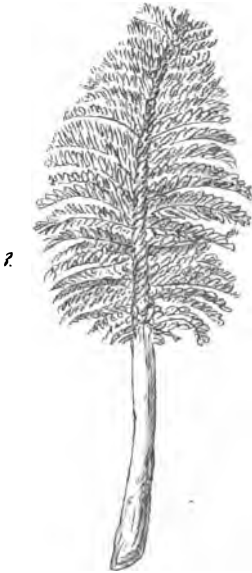
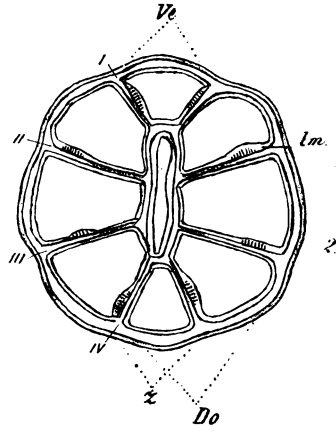
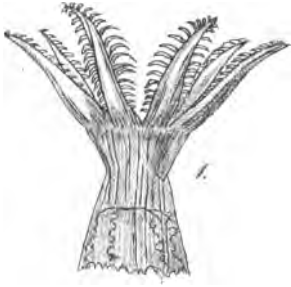




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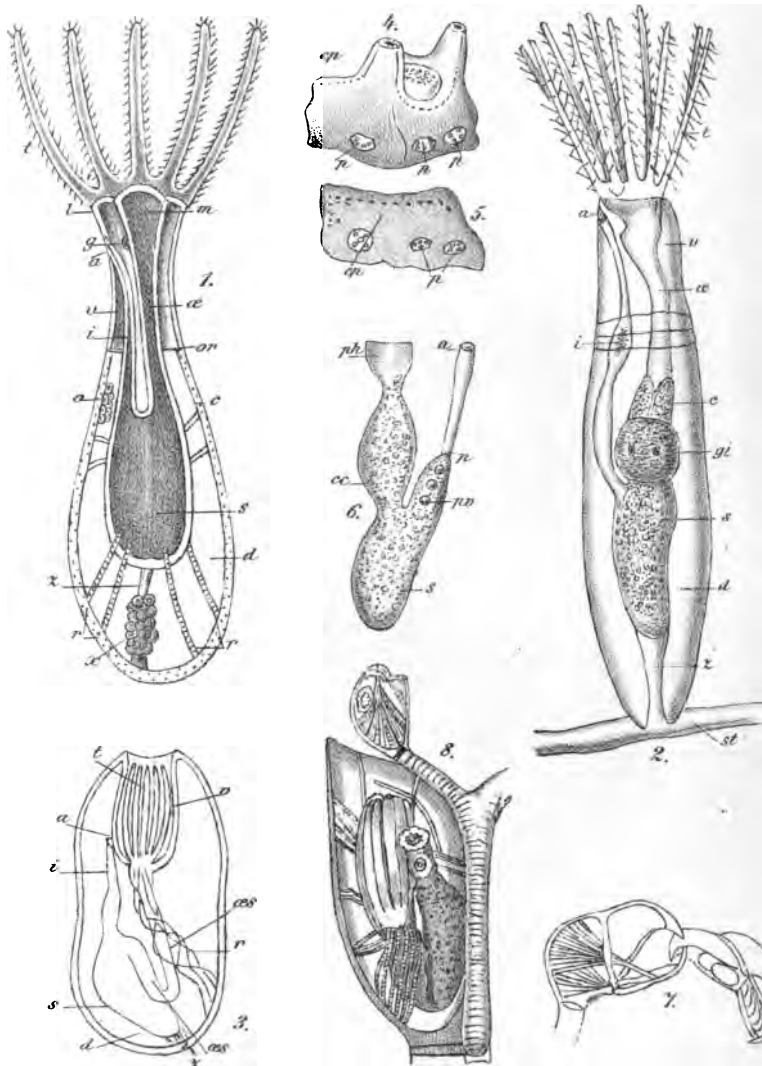


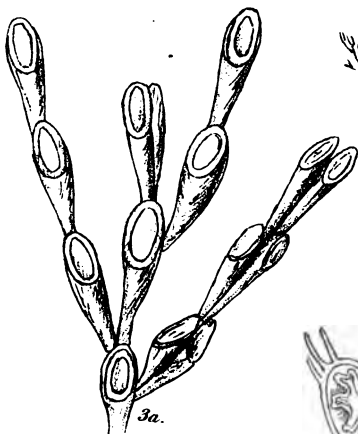
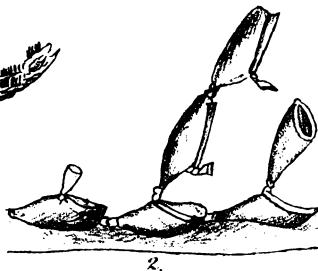
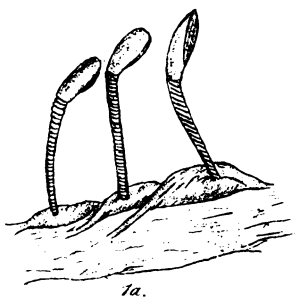






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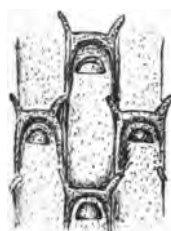
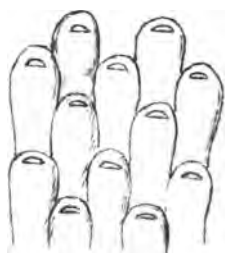
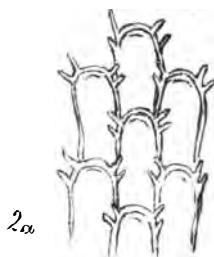
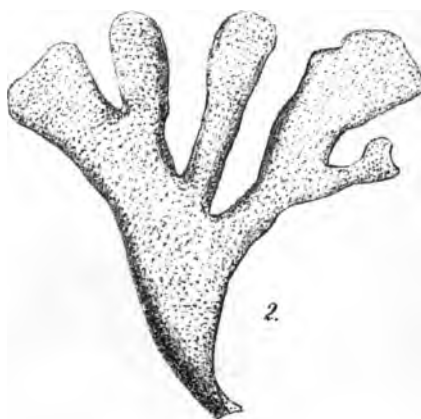






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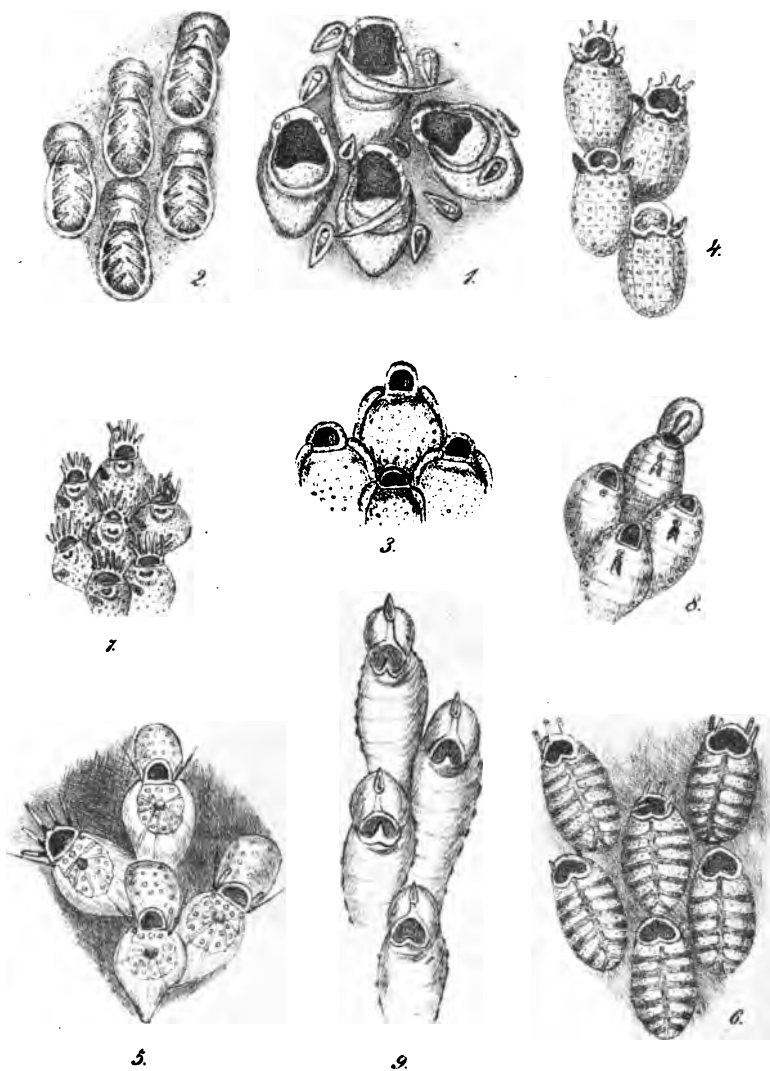


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*A P del.*







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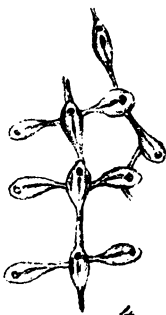
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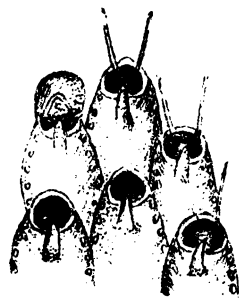
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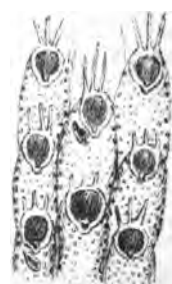
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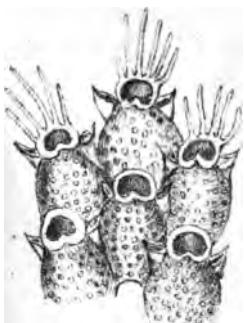


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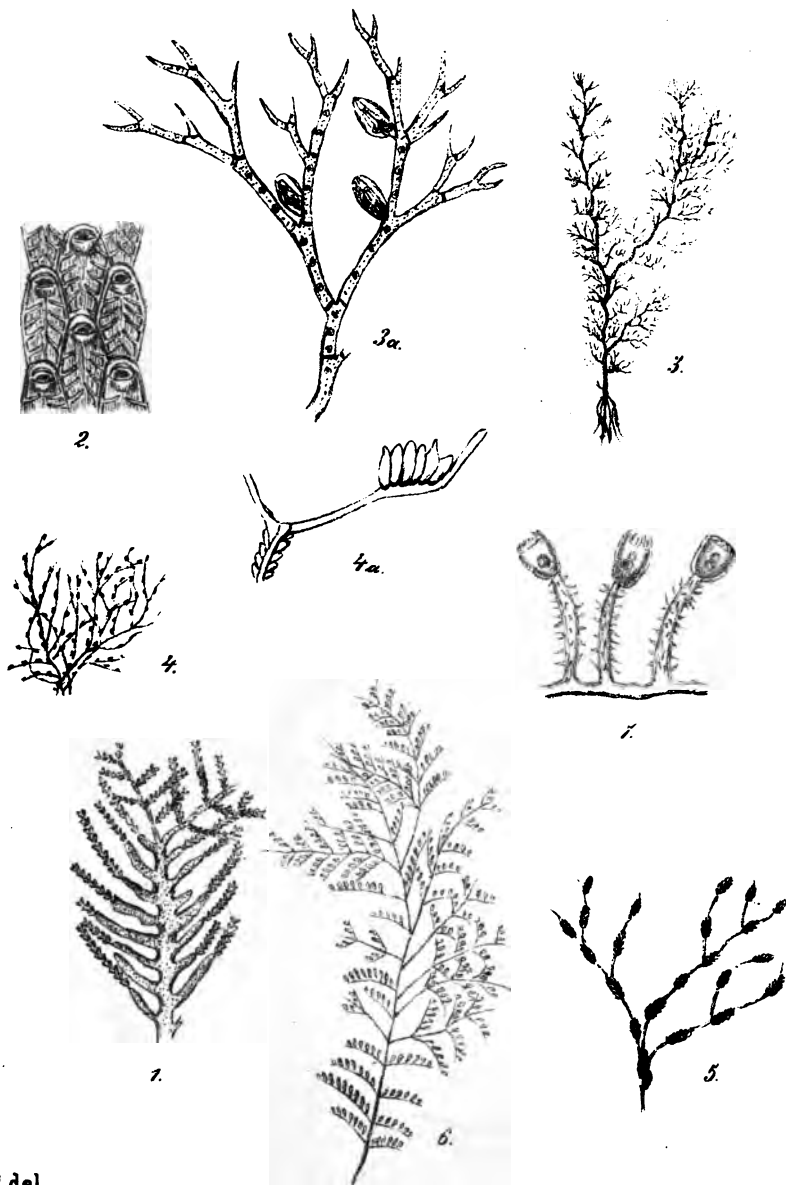






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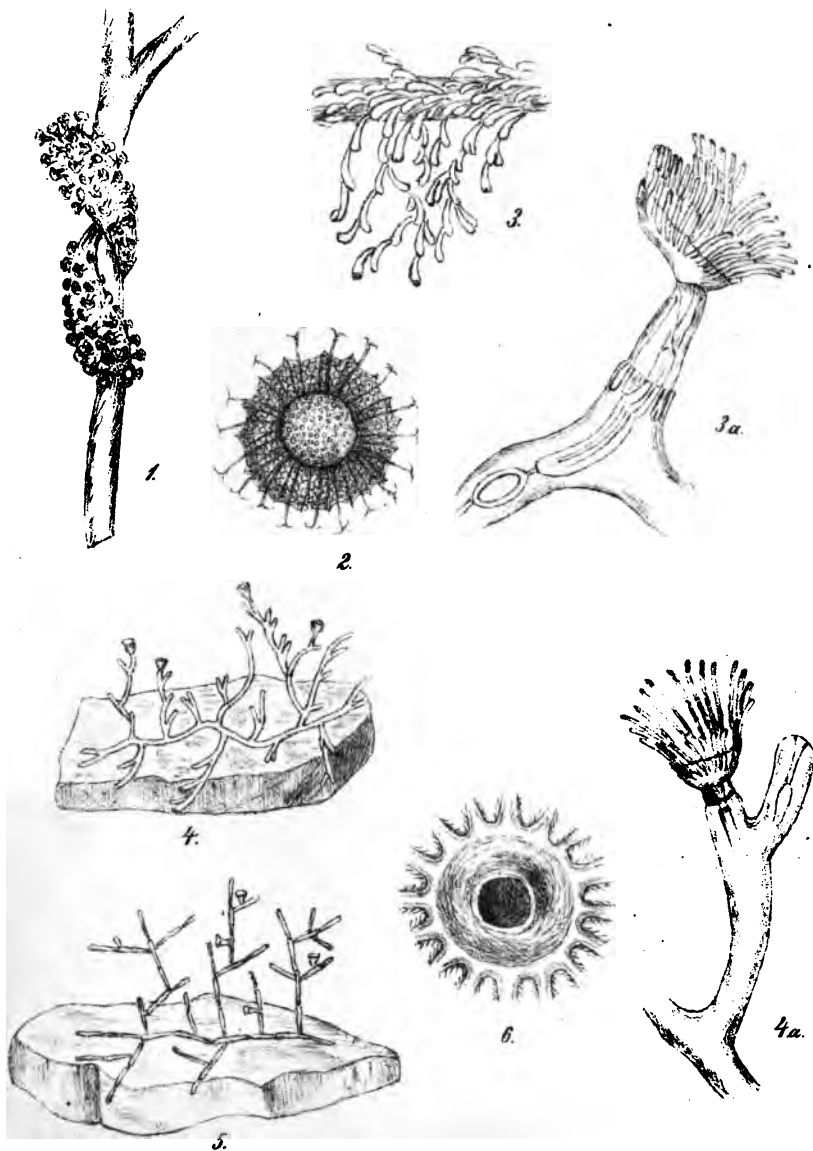
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